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COMMERCIAL SUPREMACY AND INDUSTRIAL UNREST.

REPLYING to the toast of "His Majesty's Ministers" at a dinner of the City of London Solicitors' Company a few days ago, Lord Haldane claimed that lawyers, however unpopular they might be, were the leaders of public opinion in this country, and that they exerted a tremendous influence on the country's future welfare.

Whether we agree or not with this dictum, we may perhaps admit that lawyers—due no doubt to their legal training—have the faculty of summing up and expressing tersely the trend of current thought, which otherwise finds expression in many forms which are sometimes apparently contrary in direction.

To take the case of the present industrial unrest, the dissatisfaction of organised labour with its conditions, and the feeling among employers that our commercial supremacy is threatened—all are agreed that we are faced with problems of immense magnitude, so immense as to be almost appalling, and yet it is not possible to lay the finger on any particular spot and say: "there is the cause of it all."

No would-be reformer pretends that his own particular scheme, whatever it may be, will cure all the industrial ills from which we are suffering.

It is interesting, therefore, to turn to Lord Haldane's speech (as reported in the *Times*) to see how, as a lawyer and leader of public opinion, he sums up the situation. In his opinion, we occupied our present position of "first in the world in industrial output per head of population" partly by reason of national qualities, but partly also because in the old days we had no such competitors as we have to-day. A new movement had arisen during the last six or seven years, a movement of which we were yet hardly conscious—a definite and scientific effort made abroad to raise the level of the skilled workman to a height which we as yet had not set before ourselves. This was being done by a new system of training.

The old days of apprenticeship, he considered, and we agree with him, had gone by. The apprenticeship system had done much for us in the past, but it could not successfully compete with the modern Continental and American substitute of training in trade continuation schools.

British manufacturers are inclined to scoff at the workshop training given in technical schools, and many workmen would still claim that to become efficient it is necessary to serve about seven years in the shops. This means that a boy must leave school at 14 years of age in order to become a fully-fledged workman by the time he is 21. But we must not overlook the fact that when the seven years' apprenticeship system was introduced, handicraft meant much more than it does to-day, when labour-saving machinery has entirely eliminated many of the old manual operations, so that there is now very much less for

an apprentice to learn in the shops than was the case before handicraft had been so largely superseded by machine-craft. An intelligent youth can learn as much in six months in a properly-equipped college workshop, so far as the use of tools is concerned, as he would learn in as many years of an ordinary apprenticeship under modern factory conditions.

In many parts of the Continent, as Lord Haldane pointed out, instead of boys leaving school at 13 or 14, as in this country, the training is continued until they are 16, 17 and 18 years of age, and that training is not merely in general knowledge, but in the chief point of the calling which the future workman is going to exercise.

This is a problem which, the speaker said, we shall have to face six or seven years hence.

We are really facing it now: the conditions of apprenticeship, so far as the engineering trades are concerned, have been the subject of discussion before the leading engineering societies on many occasions during the last few years, and many firms, as we have from time to time recorded in our columns, have adopted modified conditions of apprenticeship in order to meet the changed circumstances. So far as we know, the Trade Unions have taken no active steps to assist this movement, although their co-operation is most essential if we are to maintain our leading position among the great industrial nations of the world.

This lack of co-operation is, no doubt, a result of the same cause that is producing the industrial unrest which is so prevalent, not only in this country, but in the Colonies and dependencies of the Empire, and also in France, Germany, and other parts of the Continent, as well as in America.

This, as Lord Haldane suggested, is due to the fact that Labour is better educated than before, and the working classes have become conscious that the gap between those who work with their hands and those who work with their heads is unduly great, so far as remuneration and participation in the comforts of life are concerned. This is a factor which has to be reckoned with. We have to deal, the speaker remarked, with a majority, the rightness of whose cause we cannot deny. A change is bound to come, and it is of the highest importance so to prepare for it that the change may come peacefully and quietly, and in such fashion that it will make for the well-being of the State, and not its detriment. The recent disturbances in South Africa and elsewhere are all part of the same discontent, and it is essential to get down to the deep root-cause, because the movement cannot be repressed. Organised as Capital and Labour are to-day, strikes have become very serious things, and when they touch railways, the coal industry, and transport, they touch the life of the nation.

Concluding his remarks, Lord Haldane said that what we had to do was to endeavour to bring about a sense of the absolute necessity of the solidarity of conscience between the workmen and employers of this country. It could not all be on one side. Employers would have to recognise the position of the workmen, and the workmen would have to recognise that they had some further concern than the mere getting as much as they could in wages. Any man who could think out completely and adequately that problem of the future, and other problems cognate to it, and make a substantial contribution to progress along the path which must be followed by those who succeeded him, would deserve well of his country.

In what direction shall we look for that man? And when we find him, are we in a mood to follow him? Opportunity, it is said, makes the man; we certainly appear to be at the fulness of the opportunity—maybe the man is at the door! He will require to be one who is above all suspicion of partiality, and he must know both sides of the case completely. May it not happen that the expert amongst us who has conducted so many inquiries into labour disputes during the last few trying years is as well able as anybody to understand the problem of the present, and is more qualified than most to guide both master and man as regards the future, so that industrial development and prosperity may continue parallel with improvement in the condition of all ranks of workers?

British Motors and Transformers for Canada.

Our Canadian correspondent informs us that British-made motors sometimes receive a good deal of criticism over there, apparently on account of the power factor being lower than that of those made in Canada. It would perhaps be worth the while of those home firms who are doing business in electric motors in that market to look into this question, as it is not desirable that the reputation of any of their products should suffer for want of a little attention to Canadian requirements. The writer regards it as curious that very few, if any, of the thousands of transformers used in Canada come from Europe. He is at a loss to know the reason, but the fact exists that neither Britain, Germany nor any other European country seems able to find a foothold for this class of product in the Canadian market.

Whether it be on account of price, efficiency, reliability, or other cause, is not known. He continues:—"Surely if makers at home can compete in respect of electric motors, they should be able to with transformers. Perhaps as yet no sufficiently determined effort has been made. Even if the type and characteristics of the transformers used here are not familiar to British manufacturers, it should not be a difficult matter for any enterprising firm to secure one or two second-hand ones to examine and test. One can understand that it would be difficult to compete for large transformers built for very high voltages, such as 110,000 volts or over, but ordinary potentials up to 10,000 volts or so should form no serious bar to successful competition."

Numerous reports from authorities on both sides of the ocean state that trade in Canada has been decidedly quiet for some time now, and that owing to the shortage of money many projected undertakings have been held up. It is considered, however, that the splendid harvest which was obtained last year should have a very healthy effect on the situation, and no doubt the spring will see much new work put in hand. The Canadian winter, of course, puts a temporary check on a great deal of work, owing to its severity.

The Rubbber Position.

Since last writing the rubber market has at times worn quite a strong appearance, and there were some of the cheerful optimists in shares who began to wax reminiscent of the good old days when prices went soaring gaily regardless of the inevitable consequences. The general opinion is, however, that the article has really undergone a substantial improvement from the worst, so far as market conditions are concerned, and there are but few who hold a very poor opinion as to the future. Among these, however, is a Mincing Lane house which has issued a lengthy document bitterly attacking the rubber position, and while stating that the statistical outlook is about as bad as bad can be, and that the next few months will show an alarming excess of supplies over consumption, suggests that the price will drop to somewhere round 7d. or 8d. a lb. The writer of the circular is very dogmatic in his utterances, and altogether is evidently badly obsessed with the idea that rubber is "rotten," as the phrase goes, but it must be remarked that the trade has taken the utterances with cheerful philosophy, and clearly does not regard the situation as being anything like as hopeless as is it represented by this

particular interest. In spite of what is said in the circular there cannot be any serious question but that the prosecution of harvesting operations in most of the wild rubber-producing countries must have been very seriously interfered with by the slump in prices, and the consequent acute depression entailed, and still in force, notably in Brazil. The receipts at Para have been checked very substantially, which is a notable feature, and while it is just possible that supplies have been held back up country, there is no reason to think that the quantities which might be affected in this way are of any substantial importance. It is true of course that the falling-off in the receipts of wild rubber the world over has been more than compensated for by the increased quantities of plantation material which are coming forward, but consumption seems to be quite able to take care of what becomes available. The remarkable elasticity of the demands from manufacturers since the price of best plantation grades fell to near 2s. a lb. testifies to the possibilities of the consuming industries, while constituting the mainstay of the market. A further point in favour of the position is that industrial conditions in the trans-Atlantic trade are by degrees being restored to the normal, and if general developments there should be as favourable over the rest of the year as they at present promise to be there should be a greatly increased consumption in progress as the months pass.

The official returns of United States imports of crude rubber for last year are interesting, for they disclose an increase of 10,000 tons in plantation grades, the total imports of which were 22,300 English tons, which is a quantity considerably in excess of the imports of Brazilian rubber, and, indeed, an amount slightly in excess of the combined Brazilian, Central American, and African rubber which entered the country.

Regarding the trade as a whole it is a foregone conclusion that a moderate price for the article will enormously stimulate consumption. It may take a little time for new uses to be devised, but they will assuredly come, and the efforts being made in influential quarters to effect an extension of the present uses are certain to be of effect sooner or later. One of these is undoubtedly rubber flooring, for which there is a practically unlimited market if only the price is "right." The flooring which has been laid already in various parts has so far given unqualified satisfaction, and there are a number of further contracts in hand, making it clear that the material is being appreciated for this use. Generally with the improved financial position, thanks largely to easier money and to the signs of returning activity in trade at home and abroad, the outlook is improving, though it is not probable that there can be much advance in prices until fundamental conditions as regards American trade are distinctly improved.

The result of the plantation auction sales held this week at Mincing Lane was not very satisfactory compared with the previous sales, closing prices showing a fall of about 3d. a lb., though as regards recent private rates, there was not much alteration. The total quantity brought forward for sale was round 1,300 tons, a heavy amount, the bulk finding buyers with a moderate demand.

Lessons on Coal Gas.

The ingenuity and enterprise of the British Commercial Gas Association in propagating a knowledge of the sovereign merits of their products deserve all praise; we only regret that there is no corresponding association charged with the duty of upholding the pre-eminent advantages of electricity. One of their latest innovations is designed for the education of the rising generation, and is advertised in the London County Council *Gazette*. It is announced that a series of notes of lessons on coal gas as a fuel, as an illuminant, and as a source of power will appear in the *Gazette* in 1914; the notes will be written by an expert, and will be so arranged that the experienced teacher can adapt and utilise what is most suitable for the needs of his or her own class, and discard the rest. Object or picture lessons are provided for the infant classes, in addition to the more advanced presentation of the subject for use in boys' and girls' schools; the secretary of the Association will answer questions put to him by teachers, and local gas-works managers will co-operate by lending specimens of appliances or materials, drawings, &c.

"The object of the Notes is to make common knowledge of the interesting scientific facts connected with gas manufacture, distribution and use." No one can cavil at the praiseworthy purpose of the series; anything that will tend to a reduction in the number of fires, explosions, suffocations, and other accidents due to ignorance of the properties of gas tends to the public benefit. But if such teaching is necessary in the case of gas, which has been in use in London for over a century, how much more necessary is it in the case of electricity, which has been used barely one-third as long, and which is distinguished from all other agencies for lighting, heating and power production by the fact that it, like gravity, apparently has no corporeal existence, is imperceptible to the senses, and is known only by its effects on matter. To the child its operations are enshrouded in mystery, and instruction of the young is imperatively called for. And what a fertile field the science of electricity affords for the enthusiastic teacher! We grown-ups are so accustomed to the marvels of electricity that they have become to us more or less commonplace; but marvels they remain, and they constitute an inexhaustible store of interesting material for lessons and experimental demonstration. We have on previous occasions urged that popular lectures should be given for the edification of the public on the infinite variety of the applications of electricity to domestic and industrial uses; we now commend to the attention of the supply authorities the example so wisely set by their rivals.

Professional Etiquette.

The Council of the Institution of Civil Engineers recently issued a circular calling attention to the practice favoured by local authorities, whose clerks—themselves belonging to a profession in which rigid etiquette is observed—contemptuously ignore the claim of engineering to be a "profession," and invite by advertisement engineers to submit in competition with others their terms for preparing plans for engineering schemes. The Council naturally condemns this practice, and calls upon the members of the Institution to decline to respond "in any way" to such advertisements.

We have on previous occasions commented on the procedure in question, which obviously opens the door to the incompetent, and is admirably adapted to ensure that the local authority concerned shall be provided with professional advice of the worst possible quality. It is only the inexperienced and unknown "consultant," struggling for a foothold, that is likely to answer such an advertisement. But we may suggest that the more expert in such matters who see the advertisement, while not replying to it directly, know methods of indirectly making their names and terms known to the advertiser, and we take it that the comprehensive words "in any way," used by the Council, are intended to cover the back-door methods also.

If we are not mistaken, it is the practice of the Association of Consulting Engineers to send a list of the names of its members to such advertisers. Thus the Association is enabled to do as a corporate body that which its individual members may not do. The ethics of the matter are somewhat obscure; but we wonder whether the Council of the Institution approves of this proceeding.

We are not blind to the difficulty experienced by the clever and highly qualified but little-known man in making a start as a consulting engineer; his duty, according to his established elder brethren, is—to efface himself. We sympathise with him, and we see little objection to the American practice of publishing his visiting card in the advertisement pages of the technical Press; but that is by the way. The practice condemned by the Council, as mentioned above, is most objectionable on all grounds.

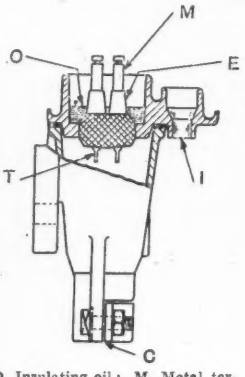
AUTOMATIC TELEPHONES, &c., AT KING'S COLLEGE HOSPITAL.

By the courtesy of Messrs. Siemens Bros. & Co., Ltd., we were recently enabled to pay a visit to their telephone works at Woolwich, and to inspect the automatic telephone exchanges which they have installed for the service of their works, and in the new King's College Hospital at Denmark Hill. The former installation has an ultimate capacity of 1,000 lines, but is at present equipped for some 200 lines, and provides intercommunication throughout the whole of the various departments of the company's extensive works at Woolwich; we understand that the convenience, rapidity and reliability of the system have been so cordially appreciated by the staff since the automatic apparatus was installed, that a return to the slower methods formerly in use would result, if not in a general riot, at any rate in consternation and a storm of protest. Not least of the advantages of the system is the immediate clearing of the line, a quality in which all manual exchanges are conspicuously and painfully deficient; thus it is possible for the head of a department, on arrival at the works in the morning—perhaps a few minutes late? Certainly not, but in a hurry to get to the heart of things—to call up half-a-dozen of his subordinates, and receive their reports as to the state of their respective branches in the space of half as many minutes. The "engaged" signal is given at once, if appropriate, and the caller always knows whether his call has been effective, for if the called subscriber's telephone is not engaged he receives a "free" tone signal.

As a rather special favour the Post Office has permitted the automatic exchange to be coupled to the public exchange system, for experimental purposes; this, of course, necessitates the addition of a private manual exchange through which the Post Office calls are passed to the local stations, the automatic apparatus being cut out of circuit when a line is through to the Post Office exchange; but the same instruments are used, with hand-combination sets, and the service appears to operate with perfect smoothness and facility. As the automatic exchange is essentially the same as that at the hospital, one description will serve for both.

In the telephone factory a variety of work was in progress, a considerable number of exchange boards of various sizes being in course of construction, chiefly for export. We noted with interest that in the latter case the boards were completely built up and wired to the distributing frame, the cables and strips of jacks being afterwards withdrawn and packed so that they can be placed in position without difficulty on arrival at their destination.

The automatic exchange at the King's College Hospital is designed for an ultimate capacity of 150 lines, of which some 90 are already in use; as the system will necessarily run into three figures, in which case *all* the numbers must



O, Insulating oil; M, Metal terminals; E, Ebonite; T, Terminals for cable leads; I, Inlet for wires; C, Inlet for cable.

Fig. 1.—External Distributing Box. Fig. 2.—Section of Box.

contain three digits, and it is undesirable to change the numbering after the exchange is brought into use, the numbers commence with 101. Two storage batteries of 30 cells each are provided, which feed also the clock, signalling and bell circuits (at low voltage); these are mounted in a room close to the power station.

The system of wiring adopted is to use 12½-lb. copper wires, enamelled, wrapped with paper saturated with beeswax, twinned and enclosed in a lead sheath. The enamel alone would provide adequate insulation. This type of wire can be run on the outside of the walls, buried in plaster, or otherwise fixed in any position without fear of breakdown, and is very inconspicuous.

The total area of the hospital site is 12½ acres, and most of the buildings are completed. In each block there is a distributing box in a convenient position, and all the boxes, numbering eventually some 18, are coupled by cables of 10 to 26-pair with one or other of six junction boxes situated at suitable points. Thus, future wiring is limited to the short distance between one of the distributing boxes and the point where the instrument is to be fixed, all other wiring being permanently in place. The junction boxes are joined together by 52 and 120-pair cables, the main box A being at the telephonic "centre of gravity" of the buildings, where, in the ordinary way, the exchange would be situated. But in order to bring all the apparatus under

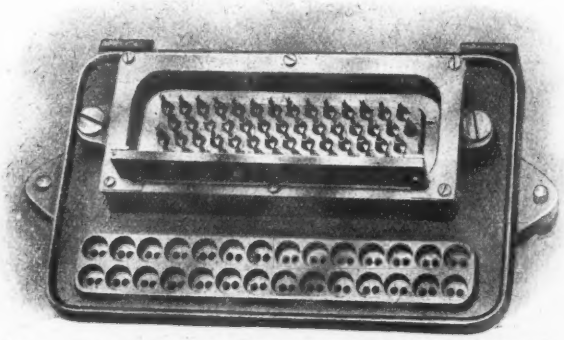


Fig. 3.—Plan of External Distributing Box (Cover removed).

the immediate supervision of the electrician in charge of the generating plant, the exchange has been erected in a convenient room adjoining the engine room and the battery room, and is connected with the central box A by

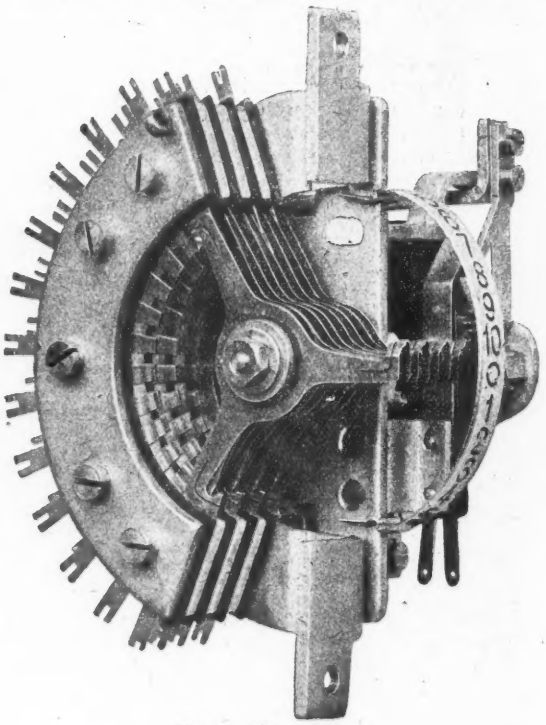


Fig. 4.—Preselector.

a 200-pair cable. The main cables are all of 10-lb. copper conductors insulated with paper, twisted up in pairs, and lead-sheathed. As the boxes provide for other circuits besides the telephones, junction box A is designed to accommodate terminal strips for 600 pairs of wires, which can be cross-connected at pleasure.

Fig. 1 shows one of the external distributing boxes, and fig. 3 a plan of a similar box with the cover removed, showing the holes through which the distributing wires enter the box, and the screw terminals. A section of the box is shown in fig. 3. The lower part of the box is filled with melted compound, and the terminals are surrounded with insulating oil. The wires are taken into the rooms through the window frames.

In fig. 7 is shown one of the wall instruments used at the hospital, with the calling dial and a neat quick-reference directory devised by the makers. The mode of operation of the system resembles that usually employed, and for a two-figure system would be as follows :—

Immediately the receiver is lifted, the instrument is connected to a "preselector," shown in fig. 4, which at once

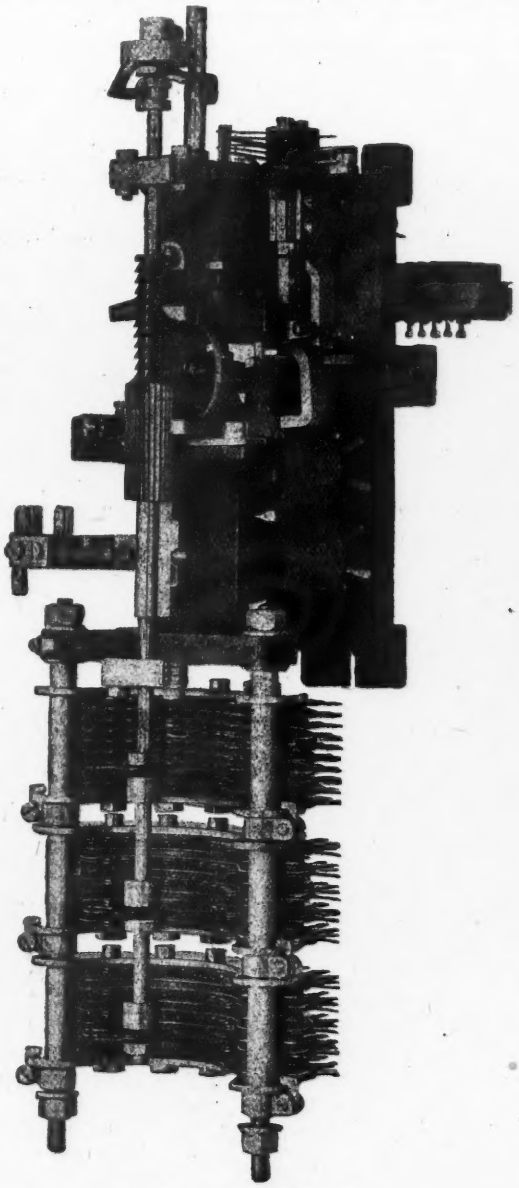


Fig. 5.—Line Connector.

picks out the first disengaged connecting line—10 lines are provided in this case. The subscriber is now through to a connector, one of which is illustrated in fig. 5; this carries the contacts representing 100 subscribers' line circuits, with their corresponding test contacts, and is controlled by a set of relays on the same rack, which are actuated by the motion of the subscriber's calling dial. The complete set of racks is shown in fig. 6. It will be understood that the first motion of the connector switch is to rise vertically to the level corresponding to the tens digit, and the second motion to rotate in a horizontal plane to the point corresponding to the units digit of the called subscriber's number. If the latter is disengaged, his bell is rung every five seconds, and the calling subscriber receives a "free" tone in his instrument; but if the number is engaged, the "busy" tone is given; on the calling subscriber replacing his receiver, the whole of the apparatus is automatically restored to its normal state. The average time occupied in making a call, up to the moment when the bell is rung, on a two-figure system is 3 to 4 seconds.

It will be remembered, however, that the hospital system is a three-figure one, but only the first two hundreds are required. In the ordinary way, the third figure necessitates a complete set of selectors in addition to the apparatus already mentioned. Messrs. Siemens Bros., however, having in view the fact that the number of subscribers cannot exceed 200, and that therefore 80 per cent. of a full-size selector would be wasted, have devised an alternative method which has now for the first time been brought into use. A "preselector" provided with contacts for 15 lines replaces the costly selector; it is called a "discriminator," its function being to connect the calling subscriber's line to a connector in the particular hundreds group in which the called subscriber's line is situated, and it can be applied to equipments up to 400 lines, by increasing the number of contacts.

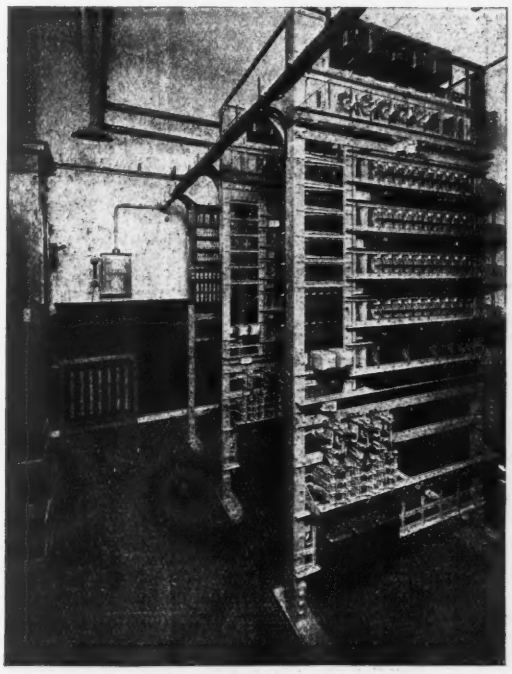


Fig. 6.—Apparatus Racks.

Thus, the apparatus successively brought into operation in putting a call through are: subscriber's dial, preselector, discriminator, connector, called subscriber's instrument.

We may mention that the ringing and tone apparatus is normally at rest, but automatically starts up directly a call is initiated. The present equipment consists of 90 subscribers' preselectors and eight connecting circuits; the discriminators are fitted, but will not be required until more than 100 stations are in use.

Besides the telephone exchange there is in the hospital an installation of 120 electric clocks and a double-faced out-door clock, controlled by a master clock with automatic winding, which is appropriately fixed in the exchange room (fig. 7). An automatic alarm is provided to inform the attendant when the battery voltage is low. The secondary dials are absolutely silent in operation. The current is derived from the telephone battery, at 26 volts.

The dials are connected in parallel on seven circuits, each of which is provided with an impulse counter and key in the exchange room; thus if any circuit gets out of order, the maintenance man can see at a glance that the counter has stopped, and after clearing the fault he can bring all the clocks on that circuit into synchronism with the others without visiting them, by means of the impulse key.

D

Another special apparatus is a staff arrival system, by means of which the porter at the main entrance can at once notify to all the rooms concerned the arrival of any member of the staff, whose names are recorded on an indicator. Two keys are employed for each circuit; the arrival key rings a bell and operates an indicator on each board; the departure key merely restores the indicator without ringing.

Thirty-six of these circuits are provided, with five boards; provision is made for 18 additional circuits on the board in the entrance hall, of which 14 are equipped at present; these circuits do not appear on the other boards. Buzzers in each ward inform the Sister in charge that the surgeon or doctor is about to visit it.

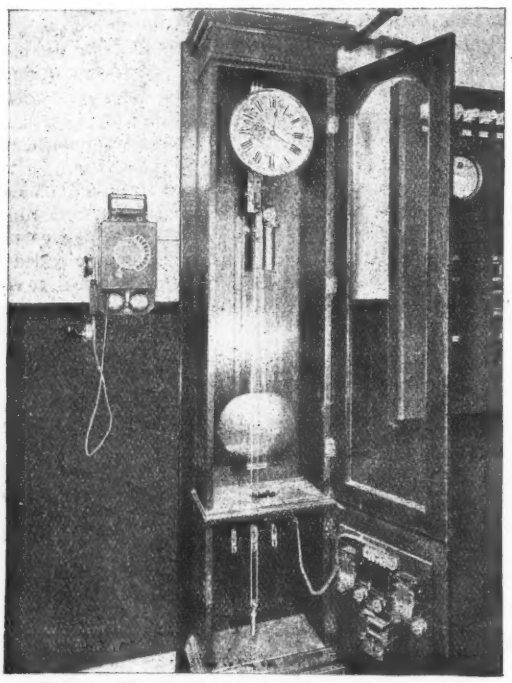


Fig. 7.—Master Clock and Wall Telephone.

A number of bell circuits has also been provided between various rooms. All the indicators and bells are wired in the same manner as the telephones, and are fed from the same battery.

It will be seen that the installation has been carried out on the most up-to-date lines, and constitutes a model of what such an installation should be. The architect was Mr. W. A. Pite, and the consulting engineer, Prof. D. S. Capper.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Protection or Tyranny?

If it is not now too late, may I draw attention to Mr. Purse's reply to my letter which appeared in your issue of the 6th inst.?

Mr. Purse appears to be very curious to know who I am, and to think it very mean of me to conceal my identity.

I can assure Mr. Purse that I meant nothing more or less than what I said, and am not trying to "get at" him, and also that I should not use a nom-de-plume if I had not very good reason for doing so.

It is very good of him to offer me one of his copies of the B.E.A.M.A.'s conditions, but I'm not to be drawn. I do not see, however, why he should not send one to you, Mr. Editor, for publication.

The fact (if it is a fact) of the B.E.A.M.A. absolutely refusing to budge from their own conditions of contract is no reason why the general electrical public should not discuss these conditions *and* those desired by the other side —the supply engineers—if they can find out what these two sets of conditions actually are, for it is quite certain that neither side can stand long against public opinion.

I repeat, perhaps Mr. Purse will take the opportunity of sending them to you and asking you to publish them.

Pollux.

February 23*rd*, 1914.

The Design of Regulating Resistances.

Although I appreciate the kindly interest of Dr. C. C. Garrard as evinced by his letter in your current issue, I do not agree that the formula: "Square the mean of the maximum and minimum amperes and multiply by the rheostat resistance" is the better.

By example A in the article, the rheostat resistance is roughly 3½ times that of the field, but this formula denotes a rheostat size 67 per cent. greater than that actually required.

In example B both formulæ give similar results, but they differ again for example C, whereas the formula I advocate closely results to the actual "summation watts" in each case.

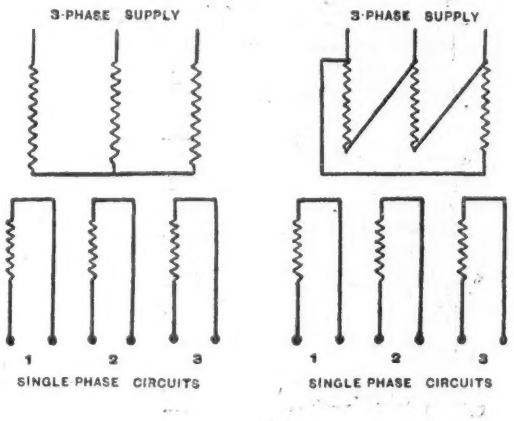
In conclusion, the greater the departure from a straight line the field current becomes (see fig. 1 in article), the greater the inaccuracy of the formula Dr. Garrard inclines to.

L. Boothman.

Stretford, *February* 21*st*, 1914.

A Query.

In reply to the query of "Ignoramus" regarding a method of connecting transformers to obtain single-phase current from a three-phase supply, the only way would be to couple up as shown in the accompanying diagram. About one-third of the load should be connected to each single-phase circuit. If the load is very variable, account must



be taken of what lights or motors are likely to be on at the same times, and these small groups must be evenly distributed on the three circuits, one-third the power required by each group being connected to each circuit. Trusting this will solve your correspondent's difficulty.

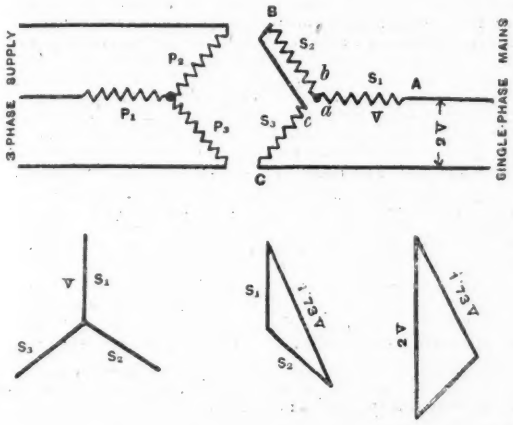
A. B. Johnstone.

Gateshead on-Tyne,
February 21*st*, 1914.

In reply to query by "Ignoramus," *re* coupling of transformers to obtain single-phase from three-phase supply, I submit the following method:—

First of all let primary of transformer be connected star, as is general, then find the neutral point of secondary by temporarily connecting in star, detach one phase from this

star connection, leaving two phases with their neutral points connected together, the neutral point of this detached phase then to be connected to the free end of either of the other two phases. The two remaining free ends are the points from which single-phase supply may be taken.



Phases S_1 and S_2 to have their neutrals *a b* connected together; phase S_3 to have its neutral point *c* connected to B of phase S_2. Then the voltage of single-phase across A and C is equal to twice the voltage per phase, as shown in the vector diagrams.

D. D. Rayner.

Leeds, *February 23rd*, 1914.

In answer to the letter of "Ignoramus," there is no direct method of obtaining single-phase current from a three-phase supply with transformers. If, however, he uses "Scott"-connected transformers, he can obtain a single-phase supply from each pair of tappings on the secondary, and by balancing the load on these the load on the three-phase supply will be also balanced.

F. G. Miller,
Second Assistant Engineer,
City of London Mental Hospital.

Dartford, *February 23rd*, 1914.

[A solution of the problem consists in using a "Gramme" armature, surrounded with a laminated iron cylinder or provided with an internal laminated core, to complete the magnetic circuit. On connecting the three-phase leads to three equidistant points in the winding, a rotating field is obtained, and a single-phase current can be tapped off from any two diametrically opposite points on the winding. There are, of course, practical objections to this method.—Eds. Elec. Rev.]

BUSINESS NOTES.

German Wire Lamp Prices.—The recent collapse in the price agreement in relationship to metallic-filament lamps, to which reference was made a few weeks ago, has now been followed by the circulation of rumours on the Berlin Exchange to the effect that negotiations were proceeding between the A.E.G. and the German Incandescent Gas Light (Auer) Co. for the re-establishment of an understanding. It turns out, however, that there is no foundation for the rumours or for other versions respecting a price arrangement in regard to other lamps, as keen competition continues and is becoming increasingly manifested in the constant advance in the discounts for wire lamps.

Argentine Orders.—The Empresa de Luz y Fuerza, of Buenos Ayres and Mendoza, which is a subsidiary of the German Transmarine Electricity Co., is having a dam constructed near Mendoza with the object of establishing hydro-electric works at an estimated expenditure of £550,000. It is stated that the largest portion of the work has been entrusted to the Compania General de Obras Publicas, which is the Argentine subsidiary of the firms of Philipp Holzmann & Co., of Frankfort-on-Main, and Gebruder Goedhart, of Dusseldorf.

German Electrical Industry.—Prof. Max Levy, of the Berlin electrical instrument manufacturing firm of that name, in the course of a recent lecture, said that the production of the aggregated German electrotechnical industry per annum totalled about one milliard marks. Of this amount, about 290,000 000 marks represented the value of the exports. The installation branch had developed into an independent entity, represented by some 4,000 firms, some of which might be relatively small. The number of electricity stations existing, according to statistics brought up to April 1st, 1913, was over 4,100. Above three-fourths of the population of Germany were at the present time able to avail themselves of the electric current. The total capacity of the electric stations was about 2,095,000 KW.; the total output amounted to about 2 milliards KW.-hours. The Berlin electricity works represented the largest single German undertaking. Its current output stood for one-eighth of the aggregate current output of German public electricity stations. The significance of the electrical industry from a national economic point of view was very considerable. It paid in general not only the best wages, but also the number of employés was very high. The profit returns of manufacturing firms were satisfactory, but not brilliant. The profit returns of electricity stations were steadily increasing, and amounted, with the limited companies, to an average of 9 9 per cent. They are considerably larger with the big stations than with the smaller. A characteristic feature of the electrical industry was its quick development everywhere; while the aggregate of industrial companies in the period from 1901 to 1911 showed an increase in the number of insured persons of 43 per cent., the advance in the electrotechnical industry amounted to 187 per cent. While the aggregate amount of wages in those callings in the period named advanced about 80 per cent., in the electrotechnical industry alone, the increase totalled 266 per cent. The only hindrance which was feared as being likely to affect the continuous flow of progress of the electrical industry was apparently, according to Prof. Levy, the intervention of unfavourable treaties of commerce.

German Imports and Exports.—A German newspaper, in dealing with the expansion of the export trade of that country in recent years, publishes the following figures in relation to electrical machinery, cables, &c.:—

	1907.	1912.	1913.
Imports.			
Dynamos, motors, transformers, &c.	£95,000	£105,000	£155,000
Electric cables	75,000	75,000	105,000
Exports.			
Dynamos, motors, transformers, &c.	£1,715,000	£2,565,000	£2,825,000
Electric cables	2,260,000	1,610,000	1,965,000

As to the respective positions occupied in the markets of the world by Germany, Great Britain and the United States, the accompanying figures are cited by the newspaper in relation to the exports and imports of the machinery and electrical industries of the three countries in 1909, 1912 and 1913:—

	Germany.	*United States.*	*United Kingdom.*
Exports in 1909	£35,600,000	£23,150,000	£34,650,000
Imports in 1909	5,550,000	1,650,000	9,200,000
Exports in 1912	£52,800,000	£42,300,000	£39,550,000
Imports in 1912	6,450,000	2,050,000	16,100,000
Exports in 1913	£59,450,000	£52,500,000	£45,750,000
Imports in 1913	7,550,000	2,050,000	17,300,000

The figures have been converted on the basis that one mark is equivalent to a shilling, although in reality about 20 marks 40 pfennigs are equal to £1 sterling.

Australian Contracts.—The Commercial Intelligence Branch of the Board of Trade has now received from the office of the High Commissioner in London for the Commonwealth of Australia, a copy of standard specification (No. 460*b*) for paper-insulated, lead-covered, multiple twin cable, for which supplies may from time to time be required by the Postmaster-General's Department. This specification may be seen by United Kingdom manufacturers of electrical supplies at 73, Basinghall Street, London, E.C.

Cable Manufacture in Holland.—The Nederlandsche Kabelfabriek Maatschappij is the name of a new company which has just been formed in Amsterdam, with a capital of £160,000, to establish works in the country for the manufacture of telegraph, telephone and electric cables of all kinds, with the exception of submarine cables. As there is a duty of 5 per cent. on all cables imported into Holland, it is considered that the new company has every prospect of success; a German engineer has been engaged as manager of the works.

Patent Application.—Mr. Justice Warrington, in the Chancery Division, will, on June 23rd, hear the petition of Graf Botho Schwerin and of Elektro-Osmose Aktiengesellschaft, of Frankfurt-on-Main, for an extension of the term of patent No. 12,431 of 1900 (granted to Graf Botho Schwerin).

Stoker Contracts.—Among recent stoker contracts of the Underfeed Stoker Co. have been the following for Corporation electricity departments:—Sheffield, 6 "E"; Wolverhampton, 4 "E"; Leicester, 2 "E"; Bury, 1 "E"; Leigh, 1 "E."

Catalogues and Lists.—THE CARRON CO., Carron, Falkirk.—Advance copies of a 8-page well-illustrated and priced pamphlet describing some new electric cooking appliances, including small cookers, grillers and toasters. Another list is in course of preparation containing particulars of new appliances suitable for use in hotels, restaurants and institutions.

MESSRS. SIMPLEX CONDUITS, LTD., 116, Charing Cross Road, London, W.C.—Two supplementary illustrated and priced catalogues dealing with "Plexsim" electric cooking and heating apparatus. The 12-page list (No. 581) includes the usual range of cooking appliances for all domestic purposes, among them being a specially rapid boiling plate in 6 and 7 in. sizes, loaded to 800 and 1,200 watts respectively. These boiling plates can be supplied with a special extension piece giving a much greater heating surface. A new type of coffee maker, curling tong heaters, bed-warmers and electric irons are also listed. List No. 527 (16 pages) contains similar information respecting the full range of designs of radiators and convectors, the radiators including a series in period designs; the "Plexsim" electric fire is also shown. Supplementary sheet T6 (No. 530) containing illustrations, details and prices of new accessories for use with their steel conduit system.

MESSRS. JAMES MCMILLAN & CO., Clun House, Surrey Street, Strand, W.C.—Illustrated price list giving particulars, weights and dimensions, of "Hydra" condensers in rectangular insulated jars and soldered rectangular metal cases.

MESSRS. WATSON, LAIDLAW & CO., LTD., 98, Dundas Street (South), Glasgow.—Twelfth edition of their catalogue of centrifugal machines and accessories. It consists of 180 pages well bound, and it contains a host of well-illustrated notices of centrifugals driven by water-motor, electric motor, and by belt, and a great deal of machinery for sugar treatment, trucks, conveyors, engines, &c. The information relating to electrical centrifugals occupies a fair share of the book.

MESSRS. KELVIN, BOTTOMLEY & BAIRD, LTD., of 16, Cambridge Street, Glasgow, have sent us a neat wall calendar for 1914, with monthly slips, above which there appears a picture in colour of vessels ploughing the deep, with an aeroplane in flight above them. "Compasses for all craft" is the appropriate legend.

WESTINGHOUSE COOPER HEWITT CO., LTD., York Road, N.—List No. 59 relates to silica mercury vapour lamps for use in the laboratory. Prices are stated.

ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., 109-111, New Oxford Street, London, W.C.—12-page publication (BJ) containing descriptive information relating to their "Viaco" insulators made of a special moulded insulating material. A table of prices and weights is given, also plates showing a number of insulators actual size.

MESSRS. SCHOLEY & CO., LTD., 151, Queen Victoria Street, London, E.C.—12-page pamphlet dealing very fully with their tool steel gears and pinions and giving illustrations, notes and test figures, showing the excellent life records obtained with same, and figures of comparative costs.

MESSRS. ROSS & CO., 62, Robertson Street, Glasgow.—Leaflet "R" contains particulars and prices of "Rosa" ignition batteries.

THE BENJAMIN ELECTRIC, LTD., 1A, Rosebery Avenue, London, E.C.—Supplementary list (No. 53) of 48 pages containing full particulars and prices of Benjamin lighting specialities, also information on industrial and other lighting, together with illustrated examples of good illumination for various classes of work obtained with reflector fittings as shown in the list. The matt paper used is effective in showing the illustrations to advantage, and is restful to the eyes.

Electrical Exhibition at Lowestoft. — What is described as an "Electrical Home Exhibition" is to be held at Lowestoft from Wednesday, April 22nd to Saturday, May 2nd. It will be under the auspices of the Corporation electricity department, and will take place in the new Skating Rink, Fremantle Road. According to a prospectus that is before us a considerable part of the building will be given up to furniture, decoration, sanitation, household requisites, food and general cookery exhibits, but an ample space has been allotted for the electrical section, which will contain cooking and heating apparatus, wiring, motors, water heaters, fittings, irons, soldering apparatus, lamps, fans, &c. The Exhibition will be opened by the Mayor and Corporation, and Messrs. H. H. Saunders and W. R. May, of the Corporation electricity department, have been appointed managers of the Electrical Section, while Mr. H. W. Larcher, of 20, Pimlico Road, London, S.W., is organising manager. There will be a number of popular features, such as baby incubators, electric cooking and ironing demonstrations, and a band of H.M. Royal Marines has been arranged for. Application forms may be obtained from the organising manager.

Boiler Contracts.—MESSRS. CLARKE, CHAPMAN AND CO., LTD., have recently booked the following among other orders for "Woodeson" patent water-tube boilers:—Rochdale Corporation, Admiralty, for Chatham Dockyard, and the Distillers' Co., Ltd., repeat orders; the Coal Distillation Co., Messrs. Dobson and Barlow (for shipment), and the North Metropolitan Electric Power Co. Orders are also in hand for the Bury, Luton and Loughborough Corporations, and for H.M. Naval Base, Rosyth.

Parliamentary Map.—MESSRS. EDWARD STANFORD, LTD., of 12-14, Long Acre, W.C., have issued (price 2s.) a map showing the proposed railways, tramways, and other schemes affecting London in connection with this Session's Parliamentary Bills.

Book Notices.—*Debentures and other Charges.* By H. W. Jordan. Jordan & Sons, Ltd. 6d. net.—This booklet contains a lecture by Mr. H. W. Jordan to the members of the Secretaries' Association, Ltd., concerning which association a little more information might be useful. Mr. Jordan's lecture forms bright and entertaining reading, but it is rather in the lighter vein than didactic, and, therefore, not of much moment to the practical secretary. Some of the pleasant chapters into which the subject is divided in treatment are: Borrowing, Use of the Debenture, Abuse of the Debenture, "Freak" Debentures, Safeguards, with various sub-titles. In the course of his remarks on "freak" debentures, Mr. Jordan refers to debentures issued by a golf club company on its entire assets, of which the only articles worth anything at all were golf balls. If the company were in difficulties a cartload of balls would be required to pay off even a small issue. Unfortunately, however, golf balls have a habit of disappearing, and therefore the debentures could hardly be deemed gilt-edged securities. Debentures of football and other club companies of a sporting character charged on gate money are, it would appear, by no means of rare occurrence, and we may learn of church debentures, or debentures issued by churchwardens, containing a charge not on the building, but on the donations, subscriptions and offertories. Reference is made to the charging of ecclesiastical incomes, "chapel" debentures, or debentures charged on the fabric of a chapel, and various other matters. There is no doubt that the law in regard to the issue of debentures and debenture stock is in urgent need of considerable revision.

"A Text-Book of Physics." Parts I and II.—Electricity and Magnetism. By J. H. Poynting and Sir J. J. Thomson. London: Charles Griffin & Co., Ltd. Price 10s. 6d.

"Wireless Telegraphy." By W. H. Marchant. London: Whittaker & Co. Price 5s. net.

"Elementary Principles of Illumination and Artificial Lighting." By A. Blok. London: Scott, Greenwood & Son. Price 3s. 6d. net.

"Mechanical Engineers' Pocket-Book, 1914." By D. K. Clark and H. H. Powles. London: Crosby Lockwood & Son. Price 4s. 6d. net.

"The Russian Year Book for 1914." By H. P. Kennard. London: Eyre & Spottiswoode, Ltd. Price 10s. 6d. net.

"Examinations in Science and Technology, 1913." London: Wyman & Sons. Price 9d. net.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIII, No. 2. February. New York: The Institute. Price $1.00.

"*Transactions* of the Illuminating Engineering Society. Vol. IX, No. 1. January. New York: The Society. Price 75 cents.

"Accuracy of the Formulas for the Ratio, Regulation and Phase Angle of Transformers." By P. G. Agnew and F. B. Silsbee. Washington: Government Printing Office.

"Die Elektrischen Metallfadenglühlampen." By C. H. Weber. Leipzig: M. Jänecke. Price M.16.

Albania's Commercial Future.—With the constitution of Albania as an autonomous principality under a European prince and the relief of the country from internal disturbances, a new epoch of industrial and commercial progress may be expected to supervene, concurrently with the development of the country's resources. As a subject of growing interest to the traders of the world, therefore, the following observations on its commercial circumstances will be found opportune.

The chief port for imports and exports and for the moment the most considerable business place for transactions with Southern Albania is Valona. Direct dealing with inland localities is, for the present, hardly feasible.

Shipments either outwards or inwards are effected mainly by Austrian and Italian ships. All the articles of daily requirement are comprised among the goods imported, for the country possesses no industries. Later on, with the gradual development of the country, a certain demand for machines will arise, and, of course, in the first place, for those appertaining to agriculture and the tilling of the soil. The circumstances of payment in Valona may be described as on the whole good. No bankruptcy has occurred for some years, and the war has made no difference in this respect. The usual terms are cash against documents. The sending of travellers to Albania is recommended, as signs of an economic awakening are evident, and exports in late months have shown a rising tendency. With respect to the Customs treatment of travellers and their samples, the Turkish regulations for the moment are those prevailing. A permit to travel must be obtained; but at Valona the regulations are not strictly enforced, and there is no need to have passes *visé*. The coinage in use is gold Napoleons (of 10 or 20 fr. value), which are current everywhere. In Valona their value is 95 piastres. The construction of both an Austrian and an Italian hotel is proceeding.

Annual Supper.—The annual supper and smoking concert of MESSRS. VAN RADEN & CO., LTD., of Great Heath, Coventry, was held on Friday evening last. The programme was very lengthy and varied.

The Half-Watt Lamp.—THE A.E.G. ELECTRIC CO., LTD., inform us that the half-watt "Nitra" lamp is now manufactured with a consumption of 100, 200 and 400 watts, for the lower voltages.

Dissolutions and Liquidations.—The Harrington Electric Light Co., Ltd.—This company is winding up voluntarily, with Mr. W. B. Smith, of 34, Market Place, Long Eaton, as liquidator.

The Electromotor Equipment Co., Ltd.—Creditors should send particulars of debts, &c., to the liquidator (Mr. O. Steiner, 21, Old Broad Street, E.C.), by March 6th. The company is winding up voluntarily. A meeting of creditors is called for March 6th at 59/65, Paul Street, London, E.C.

Brighten, Malcolm & King, Ltd.—A meeting of creditors is called for March 2nd at the offices of Messrs. Foord & Son, 16, Philpot Lane, E.C., by the liquidator, Mr. W. Lambert, Dook House, Billiter Street, E.C., to whom particulars of claims should at once be sent.

Boiler Scalers, Ltd.—March 7th is the last day for claims to be sent to the liquidator, Mr. R. B. Woodward, of 83, Queen's Circus, Battersea Park, S.W.

Pioneer Pump Patents, Ltd.—This company is winding up voluntarily, with Mr. G. H. Smart as liquidator.

Holford & Phillips, boiler composition makers, 110, Warwick Road, Earl's Court, S.W., and other addresses.—Adelina Mary Holford and Thomas Edward Phillips, also known as Frederick Phillips, have dissolved partnership. Debts due to the late firm will be received by Mr. William Holford, of Hill Rise, Kingston Hill, Surrey. Debts and liabilities owing will be paid by Mr. F. Phillips, who will continue the business at 110, Warwick Road, Earl's Court, and 6, Park Road, Ilford.

Prested Miners' Gas Indicating Electric Lamp Co., Ltd.—The accounts filed under the compulsory liquidation of this company show liabilities, £1,579; debenture claims, £768; and assets valued at £1,011. Appended is a list of the principal creditors, viz.:—

Unsecured.

Abel & Imray	£168
Benton & Stone	15
Coventry Plating Co.	13
Delta Metal Co., Ltd.	19
Greenberg & Sons	26
Gillingham & Co.	11
Hunter, W. & J., Ltd.	12
James & Co., Ltd.	21
Prestwick & Co., J. A.	709
Peat & Co., W. B.	52
Putney, Samuel, Ltd.	29
Reynolds, Ltd., G.	45
Siemens Bros. & Co., Ltd.	43
Smith & Sons	32
Tyler, T.	29
Temple Press, Ltd.	115
Uhlhorn & Co., D.	29
Walkers, Parker & Co., Ltd.	19

Globe Associated Cable and Telegraphic Services, Ltd.—A compulsory winding-up order was made by Mr. Justice Astbury on 17th inst.

Trade Announcements.—Mr. H. E. Davis announces that he has acquired the business of the late Davis Electrical Co., Ltd. (in liquidation), from the debenture-holders, and is trading under the same name, without the word "limited," at the same address, 17, Moor Street.

In consequence of increased demand for Pitter multiblade fans, British Empire business in these will in future be conducted by Messrs. Pitter's Ventilating and Engineering Co., Ltd., of 20, Bishopsgate, London, E.C.

Messrs. H. C. Poole & Son, electrical engineers and contractors, of Ealing, W., have removed to 14, Spring Bridge Road.

Mr. Heinrich Lanz, of Mannheim, maker of portable engines, &c., has established an agency at 63, Queen Victoria Street, London, E.C., and has appointed as manager Mr. P. F. Zils, who has been with the firm for many years.

Bankruptcy Proceedings.—Charles Blake (trading as the Bilston Electrical Co.), electrical engineer, 4, Church Street, Bilston, Stafford.—This debtor attended at the County Court, Wolverhampton, on February 18th, for his public examination, which had been adjourned for him to file an amended deficiency account and a trading and cash account. The Official Receiver informed the Registrar that the debtor had handed in a statement which was altogether incomplete for the purpose for which it was required. He was told that the debtor was now in a situation, and was unable to give the time necessary to the affairs of his creditors, but the order of the Court must be obeyed, and if not, he should have to apply for the examination to be adjourned *sine die*. Debtor stated that he had complied with the request to the best of his ability. The examination was adjourned.

Walter Norman Berry, 69, Atwood Road, Didsbury, Manchester, and Harry Bamber, 33, Ansdale Street, Cheetham Hill, Manchester, lately trading together as W. N. Berry & Co., at 32, Queen Street, Manchester, Lancaster, electrical engineers.—The first meeting of creditors herein was held on February 18th, at the Official Receiver's offices, Byrom Street, Manchester, but there was not a quorum of creditors present, and the matter was left in the hands of the Official Receiver. The public examination was held on Friday last at the Court House, Quay Street, Manchester. The debtor, Berry, stated that prior to entering the electrical business, he was a shipping clerk for nine years, earning a salary of 67s. 6d. per week. He commenced business in March, 1911, at Queen Street, with £463 cash capital. Altogether, however, he received over £600 from his mother's estate, of which £400 went to the bank and £63 was paid off certain advances owing to relatives. In March, 1912, he entered into partnership with Bamber, who was an electrical engineer, each debtor contributing £10. The business was successful for a time, but they afterwards extended its scope and obtained machinery on the hire purchase system. That venture, however, was unprofitable, as they could not compete with the old-established firms. In June, 1913, in the hope of obtaining more capital, a private limited liability company was formed under the style of W. N. Berry & Co., Ltd., which agreed to take over their assets and liabilities, the latter amounting to £165. The nominal capital was £1,000, divided into 990 ordinary shares, and 10 deferred shares of £1. Each debtor received 120 ordinary and five deferred shares. They had promises that other shares would be subscribed for in cash, but they only obtained £75 in this way, this amount being paid away for debts. In January, 1914, the company sublet its premises to the Northern Power and Lighting Co., the debtor Bamber entering their employ at 40s. per week. That company undertook to execute any orders which debtor obtained at a certain fixed price, but the firm of Berry and Bamber had practically no assets when these arrangements were made. They attributed their failure as a firm to insufficient capital, and to the inability of the limited company to discharge the firm's liabilities. The examination was closed.

The s.s. "Umgeni."—This vessel, which brought the South African Labour leaders to our shores, is fitted with marine type tantalum traction lamps. We are given to understand that the lamps stood even this strain satisfactorily. Messrs. Bullard, King & Co., who control the Natal line of steamships (to which the *Umgeni* belongs) have been using tantalum lamps for lighting their fleet of steamers during the past three years.

Exhibition.—The Manchester Building Trades Exhibition is to be held in the City Exhibition Hall, from March 3rd to 14th.

LIGHTING and POWER NOTES.

Aberdeen.—Plant Extensions.—The T.C. has approved a report by the electrical engineer on alterations and extensions of plant necessary. The engineer has been authorised to obtain tenders for enlarging the pump chamber on the river bank, and for the provision of a new motor-driven pump and delivery pipe to the generating station. The cost is estimated at £3,982.

Argentina.—La Electrica del Norte, which has recently disposed of its works at Tucuman to the Hydro-Electric Co., will shortly sell its works at Santiago and Jujuy, and has entered into negotiations for the disposal of one of them.—*Review of the River Plate.*

Bampton.—E.L. Proposals.—Messrs. Brooking & Co., of Exeter, promoters of an E.L. scheme for the town, have informed the U.D.C. that they propose to proceed with the erection of a power station in the town. The Council is to hold a meeting to go into the E.L. question.

Barnsley.—The T.C. has asked the local Member of Parliament to support the I.M.E.A. Bill.

Bradford.—Municipal Trading.—At a meeting of the Council of the Chamber of Trade, on Monday, a letter of protest was forwarded to the Corporation against its proposal for an extension of municipal trading in gas appliances, by opening a large shop in Darley Street, where it was intended to exhibit 200 models of cooking, heating and other appliances. The matter arose out of a complaint by Messrs. Taylor & Parsons, who objected to the Corporation setting up in direct opposition to them in practically the same street. Mr. Thos. Pratt, in moving that a strong protest be entered by the Chamber, said dealers in electrical appliances had the same grievance. The managing director of Messrs. G. A. Steinthal & Boydell, Ltd., electrical contractors, said the Chamber would have the support of the electricians in any protest it might make.

Bury.—The B. of T. has sanctioned the erection of an overhead electric main between Cemetery Road and the Gigg Paper Mills.

The Electricity Committee is submitting terms to the B. of G. for the supply of current to the Workhouse.

The Lancashire E.P. Co. has received permission from the Electricity Committee, provided an agreement is entered into, to supply current to the works of Messrs. W. Holt & Sons, Walshaw.

Chesterfield.—Loans Sanctioned and Proposed.—The T.C. has received from the L.G.B. sanction to loans of £2,500 for additional plant at the electricity works, and £4,000 for mains.

The Council has applied for another loan of £15,000 for a 2,000-kw. steam turbo-alternator, with pipe work, condensing and air filtering apparatus, switchboard and cables, a water-cooling tower, a water-tube boiler with mechanical stoker and superheaters, mechanical stokers and superheaters for three existing boilers, and the equipment of a works sub-station, and extension of the engine room.

Canada.—The Toronto Corporation hydro-electric plant made a profit of $150,000 last year.

The Kaministiquia Power Co. proposes extending its electrical plant, at an approximate cost of $600,000, including a new 14,000-h.p. hydraulic turbine and generator.—*Canada.*

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TRAMWAY and RAILWAY NOTES.

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The Tramways Committee has decided to purchase six more single-deck holiday cars, bringing the total up to 24.

Bury.—L.G.B. Inquiry.—An inquiry has been held with reference to the proposed granting of a prov. order to empower the T.C. to purchase land required for the widening of several streets to permit of the laying of a double line of tramway track.

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Continental Notes.—Bavaria.—On February 19th the Bavarian Ministry of Communications published its long-expected report on the national water powers in relation to railway electrification, and it must be admitted that the most encouraging feature in connection with the issue of this report is its public reception. There seems to be a general desire that the natural resources should be developed, and there is impatience at the official delay in dealing with the subject. The total available power is estimated to be 90,000 H.P. from eight stations which were originally projected by the Government for the supply to the railways. Of these only the Soolach plant has so far been erected, and this supplies only 4,350,000 units per annum to the local railways and industries, as compared with an available 14,400,000. The report withholds comment on the financial result of this undertaking on the grounds, first, that sufficient experience is not yet available regarding the operation of the electrified railways, and secondly, that negotiations are at present proceeding with a private company, which proposes to distribute the surplus energy and also to develop other powers at Watzmann and Hohen Göll. But the largest available source of energy is the Walchensee, which it was originally proposed to use also for the railways. In the negotiations with the landowners and other interested parties no fewer than 160 light railways have, however, been demanded as compensation, and whilst the scheme is not rejected, the Ministry of Communications regard it as impracticable so long as the sole purpose is the electrification of the railways. They propose, therefore, that the Ministry of the Interior shall work out the scheme with a view to the establishment of a general public supply system. They state, moreover, that recent improvements in steam locomotive design have materially decreased their interest in electrification, which they regard as being now less economical than steam traction, although it is not possible to determine this definitely until the national resources have been developed on a comprehensive scale for general electrical supply. Such large systems might well be in a position to offer energy to the State Railways at favourable prices. In effect, therefore, the Ministry of Communications wishes to retire from the hydroelectric field.

The negotiations for a "mixed" semi-public undertaking have now fallen through, and the report recommends that the water-powers should be worked for the national benefit by the Ministry of the Interior, from whom the matter is not likely to receive less progressive or prompt treatment than it has done in the past.

Germany.—The A.E.G. has just formed in connection with the Berlin Electricity Works Co., the A.E.G. Schnellbahn A.G., which takes over the contract held by the first-mentioned for the construction of an elevated and underground railway between Gesundbrunnen and Neukölln, Berlin. The capital of the new company has been fixed at £1,125,000 in 4½ per cent. preference shares, and £1,000,000 in ordinary shares, and authority is taken to issue £2,125,000 in 4 per cent. debentures, the interest and redemption of which will be guaranteed by the City of Berlin. In addition, the city has undertaken in the event of the estimates, apart from power station, offices and the train sidings depôt, exceeding the sum of £3,900,000, to make a contribution up to £295,000, which is to be repaid out of the company's profits after 5 per cent. has been paid. The contract further provides that the city is authorised to take over the railway on the expiration of 30 years, and then at succeeding periods of five years on giving two years' notice, on the basis of 25 times the annual average receipts in the last five years, but, if acquired at the end of the 30th year, the purchase price is to be at least 115 per cent. of the share capital. It is proposed to begin the railway in Christiania Strasse, Gesundbrunnen, and to terminate it in the Hermann Platz, on the borders of Neukölln. The railway, which will be provided with 15 stations, will have a total route length of 5·77 miles, of which 4·69 miles will be built underground, and it is to be completed within a period of five years from the date of the Government sanction.

Norway.—A company is being formed to take over and work a concession for an electric tramway, about 3½ miles long, in the outskirts of Christiania ; the estimated cost of the line is about £47,200.—*Board of Trade Journal.*

Spain.—According to *Industria e Invenciones*, a well-known Spanish engineer has laid before the Ayuntamiento, of Barcelona, a scheme to construct an aerial railway from the Plaza de la Bonanova, in Barcelona, to San Pedro Martin, in the Vallvidrera mountain district.

France.—One of the conditions of the Franco-Spanish agreement in regard to the trans-Pyrennean railway service was that the lines should be worked electrically. In this connection, the Midi Railway Co., of France, has electrified its line between Urdox and Canfranc, and proposes to adopt electric traction on the whole of its system between Toulouse and Bayonne. Although the first named line is now practically complete, it is reported that a difficulty has sprung up, which, although the power station and the rolling stock are quite ready, will prevent the running of electric trains for some time. The difficulty referred to is that the high-tension current employed for traction purposes interferes with the proper working of the State telegraph and telephone lines, which run by the side of the line. Some trials have already been made with one protective device, but this was not found altogether satisfactory, and consequently it will not be possible to put the electric trains in service until the telegraph and telephone wires have been removed a distance of at least 430 yards away from the railway.

Italy.—The *Bulletin de la Chambre de Commerce Francaise*, of Milan, states that the following schemes are now under consideration for the installation of electric tramways :—From Pordenome to Portogruaro : electric railway from Bresseo to Ponte di Barbarano (Venice) ; electric tramway from Rapollo to S. Margherita and Portofino, which the Communal Council has ceded to a company for 30 years ; tramway from Canonica di Cavo to Fogliaro (Varese) ; an electric tramway from Orzinnovi to Qunzano, Verolanova and Asola ; an electric line uniting Ravenna with Porto Corsini ; and the conversion of the steam line between Bologna and Imola to electric traction.

The construction of the electric main line railway from Milan to Genoa will be taken in hand so soon as the Chamber of Deputies has voted the credit of 150,000,000 fr. required for this undertaking. The final course of this line has not yet been decided upon ; several of the schemes under consideration effect a considerable shortening of the track as first proposed.

Coventry.—New Plant.—The Tramways Committee has recommended that a new condenser, &c., be purchased for the Priestley's Bridge plant, at an estimated cost of £1,100, and that new mechanical stokers be fitted to two of the boilers at an estimated cost of £500.

Hull.—Rate Relief.—The Tramways Committee has decided to set aside £7,000 out of the £12,000 profit on the tramways undertaking in relief of rates, as against £12,000 last year. The expenditure during the year increased by £2,188, and the income by £2,182. Salaries and wages had increased by £2,355.

Doncaster.—Tramways Extensions.—The Light Railway Commissioners have consented to the proposed extension of the Corporation tramways to Warmsworth and Woodlands.

Japan.—It is proposed to extend the electric tramways in Tokio by about 15 miles during the present year. Fifty new cars are to be added to the rolling stock.

L. & N.W. Railway Electrification.—The annual report of the above company states that good progress is being made with the conversion of the Chalk Farm to Willesden section of the line. The power station at Stonebridge Park is under construction, and contracts will shortly be let for six sub-stations and the new carriage sheds. The track work for the electrification of the line between Willesden (High Level) and Earl's Court Junction is nearly complete.

Lancs. and Yorks. Railway Electrification.—At the annual meeting of the above company last week, the chairman said the estimate of capital expenditure for the ensuing year was £684,810, including £125,000 for electric power stations. That referred to a new power station about to be erected at Clifton Junction. It was proposed to electrify the existing lines from Manchester, through Crumpsall, to Bury, and they had little doubt, judging from experience in the Liverpool district, that the additional traffic would well justify the expenditure. Referring to the electric power and light account, he said that the small cost of generating electricity, showed the expediency of the company generating its own power. Included in the statistical returns are figures relating to electric power and lighting, from which its appears that generation and distribution costs amounted to £35,769, and that £10,000 was provided for renewals. The H.T. energy generated and supplied, is classified as follows :—Traction, 28,719,591 units ; power, 1,576,484 units ; and lighting, 1,758,679 units.

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Bury.—L.G.B. Inquiry.—An inquiry has been held with reference to the proposed granting of a prov. order to empower the T.C. to purchase land required for the widening of several streets to permit of the laying of a double line of tramway track.

Canada.—According to the *Pall Mall Gazette*, Mr. George Bury, vice-president of the Canadian Pacific Railway, is at present in New York for the purpose of studying railroad electrification. It is understood that his study of the subject is connected with a project for electrifying the new tunnel through the Selkirks near Roger's Pass, British Columbia. The tunnel, which is five miles in length and carries two tracks, will be completed in the autumn of 1915, and its estimated cost is £1,600,000.

Continental Notes.—Bavaria.—On February 19th the Bavarian Ministry of Communications published its long-expected report on the national water powers in relation to railway electrification, and it must be admitted that the most encouraging feature in connection with the issue of this report is its public reception. There seems to be a general desire that the natural resources should be developed, and there is impatience at the official delay in dealing with the subject. The total available power is estimated to be 90,000 H.P. from eight stations which were originally projected by the Government for the supply to the railways. Of these only the Soolach plant has so far been erected, and this supplies only 4,350,000 units per annum to the local railways and industries, as compared with an available 14,400,000. The report withholds comment on the financial result of this undertaking on the grounds, first, that sufficient experience is not yet available regarding the operation of the electrified railways, and secondly, that negotiations are at present proceeding with a private company, which proposes to distribute the surplus energy and also to develop other powers at Watzmann and Hohen Göll. But the largest available source of energy is the Walchensee, which it was originally proposed to use also for the railways. In the negotiations with the landowners and other interested parties no fewer than 160 light railways have, however, been demanded as compensation, and whilst the scheme is not rejected, the Ministry of Communications regard it as impracticable so long as the sole purpose is the electrification of the railways. They propose, therefore, that the Ministry of the Interior shall work out the scheme with a view to the establishment of a general public supply system. They state, moreover, that recent improvements in steam locomotive design have materially decreased their interest in electrification, which they regard as being now less economical than steam traction, although it is not possible to determine this definitely until the national resources have been developed on a comprehensive scale for general electrical supply. Such large systems might well be in a position to offer energy to the State Railways at favourable prices. In effect, therefore, the Ministry of Communications wishes to retire from the hydroelectric field.

The negotiations for a "mixed" semi-public undertaking have now fallen through, and the report recommends that the water-powers should be worked for the national benefit by the Ministry of the Interior, from whom the matter is not likely to receive less progressive or prompt treatment than it has done in the past.

Germany.—The A.E.G. has just formed in connection with the Berlin Electricity Works Co., the A.E.G. Schnellbahn A.G., which takes over the contract held by the first-mentioned for the construction of an elevated and underground railway between Gesundbrunnen and Neukölln, Berlin. The capital of the new company has been fixed at £1,125,000 in 4½ per cent. preference shares, and £1,000,000 in ordinary shares, and authority is taken to issue £2,125,000 in 4 per cent. debentures, the interest and redemption of which will be guaranteed by the City of Berlin. In addition, the city has undertaken in the event of the estimates, apart from power station, offices and the train sidings depôt, exceeding the sum of £3,900,000, to make a contribution up to £295,000, which is to be repaid out of the company's profits after 5 per cent. has been paid. The contract further provides that the city is authorised to take over the railway on the expiration of 30 years, and then at succeeding periods of five years on giving two years' notice, on the basis of 25 times the annual average receipts in the last five years, but, if acquired at the end of the 30th year, the purchase price is to be at least 115 per cent. of the share capital. It is proposed to begin the railway in Christiania Strasse, Gesundbrunnen, and to terminate it in the Hermann Platz, on the borders of Neukölln. The railway, which will be provided with 15 stations, will have a total route length of 5·77 miles, of which 4·69 miles will be built underground, and it is to be completed within a period of five years from the date of the Government sanction.

Norway.—A company is being formed to take over and work a concession for an electric tramway, about 3½ miles long, in the outskirts of Christiania; the estimated cost of the line is about £47,200.—*Board of Trade Journal.*

Spain.—According to *Industria e Invenciones*, a well-known Spanish engineer has laid before the Ayuntamiento, of Barcelona, a scheme to construct an aerial railway from the Plaza de la Bonanova, in Barcelona, to San Pedro Martin, in the Vallvidrera mountain district.

France.—One of the conditions of the Franco-Spanish agreement in regard to the trans-Pyrennean railway service was that the lines should be worked electrically. In this connection, the Midi Railway Co., of France, has electrified its line between Urdox and Canfranc, and proposes to adopt electric traction on the whole of its system between Toulouse and Bayonne. Although the first named line is now practically complete, it is reported that a difficulty has sprung up, which, although the power station and the rolling stock are quite ready, will prevent the running of electric trains for some time. The difficulty referred to is that the high-tension current employed for traction purposes interferes with the proper working of the State telegraph and telephone lines, which run by the side of the line. Some trials have already been made with one protective device, but this was not found altogether satisfactory, and consequently it will not be possible to put the electric trains in service until the telegraph and telephone wires have been removed a distance of at least 430 yards away from the railway.

Italy.—The *Bulletin de la Chambre de Commerce Francaise*, of Milan, states that the following schemes are now under consideration for the installation of electric tramways:—From Pordenome to Portogruaro: electric railway from Bresseo to Ponte di Barbarano (Venice); electric tramway from Rapollo to S. Margherita and Portofino, which the Communal Council has ceded to a company for 30 years; tramway from Canonica di Cavo to Fogliaro (Varese); an electric tramway from Orzinnovi to Qunzano, Verolanova and Asola; an electric line uniting Ravenna with Porto Corsini; and the conversion of the steam line between Bologna and Imola to electric traction.

The construction of the electric main line railway from Milan to Genoa will be taken in hand so soon as the Chamber of Deputies has voted the credit of 150,000,000 fr. required for this undertaking. The final course of this line has not yet been decided upon; several of the schemes under consideration effect a considerable shortening of the track as first proposed.

Coventry.—New Plant.—The Tramways Committee has recommended that a new condenser, &c., be purchased for the Priestley's Bridge plant, at an estimated cost of £1,100, and that new mechanical stokers be fitted to two of the boilers at an estimated cost of £500.

Hull.—Rate Relief.—The Tramways Committee has decided to set aside £7,000 out of the £12,000 profit on the tramways undertaking in relief of rates, as against £12,000 last year. The expenditure during the year increased by £2,188, and the income by £2,182. Salaries and wages had increased by £2,355.

Doncaster.—Tramways Extensions.—The Light Railway Commissioners have consented to the proposed extension of the Corporation tramways to Warmsworth and Woodlands.

Japan.—It is proposed to extend the electric tramways in Tokio by about 15 miles during the present year. Fifty new cars are to be added to the rolling stock.

L. & N.W. Railway Electrification.—The annual report of the above company states that good progress is being made with the conversion of the Chalk Farm to Willesden section of the line. The power station at Stonebridge Park is under construction, and contracts will shortly be let for six sub-stations and the new carriage sheds. The track work for the electrification of the line between Willesden (High Level) and Earl's Court Junction is nearly complete.

Lancs. and Yorks. Railway Electrification.—At the annual meeting of the above company last week, the chairman said the estimate of capital expenditure for the ensuing year was £684,810, including £125,000 for electric power stations. That referred to a new power station about to be erected at Clifton Junction. It was proposed to electrify the existing lines from Manchester, through Crumpsall, to Bury, and they had little doubt, judging from experience in the Liverpool district, that the additional traffic would well justify the expenditure. Referring to the electric power and light account, he said that the small cost of generating electricity, showed the expediency of the company generating its own power. Included in the statistical returns are figures relating to electric power and lighting, from which its appears that generation and distribution costs amounted to £35,769, and that £10,000 was provided for renewals. The H.T. energy generated and supplied, is classified as follows:—Traction, 28,719,591 units; power, 1,576,484 units; and lighting, 1,753,679 units.

Leicester.—Annual Accounts.—The gross receipts of the Corporation tramway undertaking (including electric power supply) for 1913 were £58,165. The net surplus was £20,048, of which the Tramways Committee has recommended that £10,000 should be applied to rate relief.

Newcastle-on-Tyne.—Rate Relief.—The Tramways Committee has granted a further £6,000, making £18,000 in all, towards the relief of the rates out of the estimates for next year. This will practically wipe out the estimated deficiency on the Corporation expenditure next year.

London.—At the inquest on the driver of the tramcar which got out of control and dashed into a stationary car at Harringay on the 16th inst., a brake specialist employed by the M.E.T. Co. said that when he examined the car, which was eight or nine years old, after the accident, the hand-brake was in perfect order; there was an abrasion on one of the cables of the electric brake which would cut off the current if it came into contact with another metallic substance. The driver was killed through jumping off the car, and a rider was added to the verdict of "Death by misadventure," to the effect that cars should be examined by Scotland Yard more than once a year.

U.S.A.—The New York Edison Co., which is deriving an annual income of £50,000 from the charging of the batteries of electric motor vehicles, has established a special office to advise traders as to the advantages of electric vehicles for delivery work. No charge is made for the service, the only recompense the company expects being the revenue derived from the sale of energy.

South Shields.—Year's Working.—The estimates of the Corporation tramways department for the year ending March 31st next, show a net surplus of £7,410, an increase of £1,092 on the previous year. The estimated total revenue amounts to £38,080, an increase of £3,928. The adoption of the universal 1d. fare resulted in an astonishing increase of traffic, the passengers carried totalling over 10 millions, an increase of 1½ millions. Working expenses increased from £19,221 to £22,020. The Tramways Committee has decided to recommend that £1,700 be transferred to the relief of the rates.

TELEGRAPH and TELEPHONE NOTES.

Germany.—A large 8,000-cycle alternator has recently been brought into use in the Telefunken station at Nauen. With this plant spark-gaps are dispensed with, only a transformer and a condenser being used.

Japan.—Messrs. Siemens are constructing a large wireless telegraph plant for the Imperial Government. There will be two 160-kw. Diesel-driven d.c. generators, a large battery, and a 500-cycle motor-driven alternator, the spark system being used.

A project is under consideration for the installation of a wireless telephone system between Japan and the Island of Formosa, a distance of between 600 and 700 miles.

New Belgian Cables.—The Belgian Minister of Marine has signed an agreement with the Eastern Telegraph Co. for the establishment of two new submarine cables, one connecting Belgium with Porthcurno, on the British coast, and another connecting Loanda with Banana, in the Belgian Congo. All telegrams from the British African coast to the European continent will henceforth pass through Belgium *viâ* Ostend or Antwerp, thus effecting a great saving in time and expense; while the cost of telegraphing between Belgium and the Congo will be reduced 40 per cent., in addition to the gain in speed.—*Daily Telegraph.*

New Telephone Cable.—A new cable is to be laid jointly by the British and Dutch Governments during this year, and will be the longest cable of its kind in the world, covering a stretch of 79 nautical miles between Aldeburgh and Walcheren. It will be of the four-core coil-loaded type.

Safety of Life at Sea.—The full terms of the International Convention for the Safety of Life at Sea were published last week in the form of a Blue-book (Cd. 7,246). We have already given the principal features of the Convention as far as they relate to wireless telegraphy.

Spain.—The Marconi Co. has opened three new wireless stations at Finisterre, Santander and Cape Palos.

The Imperial Wireless Contract.—On Thursday last week the motion for the appointment of a Committee of the House of Lords to inquire into charges against Lord Murray was carried without dissent, but the Government refused to take any part in the matter.

Wireless Telephony.—It is reported from New York that a Marconi operator on an American coasting steamship has developed a simple transmitter for wireless telephony, with which he can speak to any ordinary receiver within a radius of 25 miles.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—February 28th. U.D.C. Transformer, high and low-tension switchgear and instruments. Supply of cables and feeder pillars.

March 2nd. U.D.C. Service cable; d.c. and a.c. meters; joint boxes, &c. See "Official Notices" February 13th.

Aberaman.—March 12th. Electrical goods for a year for the Powell Duffryn Steam Coal Co., Ltd. Stores Manager.

Ardee.—March 2nd. Public lighting by electricity for three years, for the Town Commissioners, from September 1st. Particulars from Mr. T. Malone, Town Clerk.

Australia.—Sydney.—March 18th. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" February 6th.

Newcastle.—April 29th. P.M.G. Electrically-controlled clocks at Post Office, Newcastle, N.S.W. Schedule No. 361. See "Official Notices" to-day.

Melbourne.—March 5th. 20,000-volt and 1,500-volt underground cables and accessories, for Agent-General for Victoria. See "Official Notices" February 6th.

April 7th. P.M.G. Accumulator batteries (Tudor) for radio-telegraph stations. Relays, non-polarised. Stores Schedule 996. See "Official Notices" to-day.

April 21st. P.M.G. Telephone switchboards. Schedule No. 1,005. See "Official Notices" to-day.

March 24th. P.M.G. Automatic switchboard apparatus for Geelong. Schedule No. 1,016. See "Official Notices" to-day.

Adelaide.—April 8th. P.M.G. Switchboards, various. Schedule No. 315. See "Official Notices" to-day.

Perth.—March 7th. High-tension cables, telephone cable and accessories for the West Australian Government. See "Official Notices" February 13th.

Aylesbury.—March 7th. U.D.C. Contract 2. Two 100-kw. Diesel oil engine d.c. generating sets, with static balancers, battery boosters and accessories. See "Official Notices" February 13th.

Barnes.—March 9th. U.D.C. Distributor cables. See "Official Notices" February 20th.

Barrow-in-Furness.—March 2nd. Corporation. Twelve months' supply of electrical stores for the Electricity Department. Forms of tender from the Borough Electrical Engineer.

March 3rd. Corporation. Installation of electric light at Blake Street Infants' School for the Education Committee. Specifications (£1 1s.) from the Borough Electrical Engineer.

Bedford.—March 7th. Corporation. Electrically-driven centrifugal pumping plant (four single-phase, 2,000-volt motors, &c.). Specifications, &c., from Major Tulloch & Haworth, 28, Victoria Street, S.W.

Bedwas.—March 5th. Electrical goods for a year for the Bedwas Navigation Colliery Co., Ltd. The Secretary.

Belfast.—March 11th. 36 cwt. of electric copper wire for the Harbour Commissioners. See "Official Notices" to-day.

Blackburn.—Corporation. Supply of iron, steel, bolts, screws, &c., for the Tramways Department. Lists from Mr. J. H. Cowell, General Manager.

Burton-upon-Trent.—March 14th. Corporation. One 1,250-kw. three-phase turbine-alternator and condenser, pipe-work, valves and accessories. Extensions to high-tension switchboard. See "Official Notices" February 13th.

Cape Colony.—March 16th. Water-power plant for Municipality of Paarl, Cape Province (see Electrical Review, page 183, January 30th). Time extended to March 16th. Specifications can be seen in London (C.I. Department, Board of Trade).

Carshalton (Surrey).—March 11th. Motor-generator, switchgear, battery charging board and connections, &c., at the Queen Mary's Hospital, for Metropolitan Asylums Board. See "Official Notices" to-day.

Colchester.—March 2nd. Corporation. Twelve months' supply of stores for the Electricity Department. Forms of tender from Mr. W. Frisby, Borough Electrical Engineer, 36, Osborne Street.

Coventry.—Guardians. Extension of E.L. system at the workhouse. Particulars from T. F. Tickner, architect, High Street Chambers.

Crete.—March 13th. Tenders for the concession for electric tramways and water supply. See this column Feb. 20th.

Dover.—March 10th. Electric cables and electrical sundries for a year for the Harbour Board. Mr. Martyn Mowll, registrar, Castle Street (2/6 each schedule).

Dublin.—March 2nd. Corporation. One 210-B.H.P. three-phase E.H.T. motor. See "Official Notices" February 20th.

Dundalk.—March 10th. U.D.C. Twelve months' supply of stores for the electricity department. See "Official Notices" to-day.

Dundee.—March 4th. Corporation. Twelve months' supply of electrical stores for the Tramways Department. Specifications from Mr. P. Fisher, General Manager, Tramways Office.

East Ham.—March 14th. Corporation. Supply of uniform for tramway employés. Forms of tenders from Town Clerk.

Edinburgh.—February 28th. Corporation. Electric lighting installation at the South Gray's Close and Fountainbridge Wash-houses. Specifications from Engineer's Office. Town Clerk.

March 9th. Corporation. Maintaining house telephone and electric bell installations. Forms of tender from Superintendent of Works, City Road.

March 9th. Corporation. Twelve months' supply of electrical and insulating material. Specification from the Resident Electrical Engineer, Dewar Place.

Exeter.—March 7th. Corporation. Supply of uniform and caps for the tramway department. Particulars from Manager, Eaton Place.

France.—Saint Etienne.—April 30th. Tenders are invited for the supply of the following telephone material, in three lots:—(1) 165 magnetos; 155 trembling bells; 670 cords to pattern. Particulars, cahier des charges, &c., from the Bureau des Approvisionnements de la Manufacture Nationale d'Armes de Saint-Etienne. Readjudication on lots not adjudged upon will take place on June 1st.

Paris.—March 10th. The Administration des Chemins de Fer de l'Etat (72, Rue de Rome), invite tenders for the supply of electric machine tools for the central electric material workshops at Garenne. Particulars obtainable from the Bureaux du Service Electrique (3e Division).

Gillingham.—March 6th. Corporation. Twelve months' supply of meters, cables and other stores. See "Official Notices" February 20th.

Gorton (Manchester).—March 3rd. Great Central Railway Co. Six months' supply of stores. See this column February 20th.

Heston and Isleworth.—March 7th. U.D.C. Twelve months' supply of stores, including cables, meters, &c., for the electricity works. See "Official Notices" February 20th.

Leeds.—March 3rd. Tramways and Electricity Committee. Reconstruction of certain portions of tramway track. Specifications from Tramway Offices.

Liverpool.—March 9th. Electrical fittings for a year, for B.G. Mr. G. W. Coster, Clerk, Parish Offices.

London.—L.C.C. March 2nd. Twelve months' supply of electrical sundries; forms of tender from the office of the Asylums Committee, 6, Waterloo Place, Pall Mall, S.W.

It is proposed to invite tenders from selected firms for the installation of electric light at the Belsize fire station.

March 18th. Electrical installation at the Upper Marylebone Street Elementary School, Gt. Portland Street, W. (148 points, 200 lights). See "Official Notices" to-day.

Fulham.—March 5th. Guardians Supply for various periods of electrical requisites. Particulars from Clerk to the Guardians.

St. Pancras.—March 2nd. Corporation. Supply of arc lamp carbons. See "Official Notices" February 6th.

Shoreditch.—March 3rd. Corporation. Extra-high-tension and low-tension switchgear. See "Official Notices" February 6th.

March 12th. Bellhangers' work to buildings in the London district during three years. See "Official Notices" February 20th.

Battersea.—March 3rd. Corporation. Twelve months' supply of stores for electricity department. See "Official Notices" February 13th.

Westminster.—March 11th. Guardians. 12 months' supply of electrical lamps, fittings, &c. Form of tenders from Mr. W. J. Lickley, Clerk, Prince's Row, Buckingham Palace Road, S.W.

Londonderry.—March 14th. Corporation. Meters and cables for the Electric Light Department. Specifications from the City Electrical Engineer.

Macclesfield.—March 11th. Electrical goods for one year for the Cheshire County Asylum, Parkside, Macclesfield. Forms from Mr. W. Tingay, Clerk of Asylum.

Madeira.—March 31st. General Council of Administration of the District of Funchal, on the Island of Madeira. See this column February 20th.

Newport (Mon.).—March 3rd. E.L. fittings for the B.G. Mr. A. H. Rees, Clerk, Queen's Hill.

Natal.—March 11th. Corporation. Supply of 12 miles steel girder tram rails, fish plates, bolts, nuts, tie bars, 3,000 copper rail bonds, and 275 cross bonds for the electric tramways. Specifications (£2 2s.) from Webster, Steel & Co., agents to the Durban Corporation, 5, East India Avenue, E.C.

New Zealand.—March 26th. The Dominion Portland Cement Co., Ltd. Hydro-electric plant, Wairua Falls. See "Official Notices" February 13th.

Auckland.—April 21st. The Harbour Board. 1-ton and 2-ton truck cranes. Specifications from London agents, Messrs. W. and A. McArthur & Co., 18, Silk Street, Cripplegate, London, E.C.

Pembroke (Dublin).—March 2nd. U.D.C. For 12 months' supply of electrical stores. Specification from Mr. J. C. Manly, Clerk, Town Hall, Ballsbridge.

Plymouth.—March 19th. Corporation. Registering punches for tramways system. Town Clerk.

Rotherham.—March 12th. Corporation. One 2,000-KW. high-pressure turbo-alternator with condensing plant, switchgear, steam and exhaust piping and accessories; one 1,000-KW. rotary converter, transformer and switchgear; one 20-ton overhead crane. See "Official Notices" February 20th.

Southampton.—March 9th. Corporation. For supply of rotary converter, balancer, and direct-current meters. Specification from the Borough Electrical Engineer.

Southend-on-Sea.—Six Diesel oil engines for new substations for the T.C. Mr. R. Birkett, Electrical Engineer.

Spain.—March 7th. The municipal authorities of Ribadesella (province of Oviedo) are inviting tenders for the concession for the electric lighting of the town during a period of five years.

Swansea.—March 4th. Steam coal for three, six, nine, or twelve months, for the Corporation electricity works. Borough Electrical Engineer.

March 13th. Corporation. Cable ducts, cables, pilot and telephone wires, joint boxes, &c. See "Official Notices" to-day.

Swindon.—March 7th. Corporation. Twelve months' supply of stores for electricity and tramways departments. See "Official Notices" February 18th.

Warlingham.—March 2nd. E.L. sundries for a year, for Croydon Borough Mental Hospital. Clerk of the Hospital.

Warrington.—March 14th. Corporation Gas Committee. Dynamo, 220 volts direct-current, 30 KW. Particulars from Mr. W. S. Haddock, General Manager, Gas Offices.

West Ham.—March 5th. Guardians. Six months' supply of electrical fittings. Specifications from Mr. T. Smith, Clerk to Guardians, Board Room, Union Road, Leytonstone, N.E.

Wimbledon.—March 6th. Corporation. Twelve months' supply of stores for electricity department. See "Official Notices" February 20th.

Worle (Somerset).—March 19th. Street lighting for the Parish Council. Mr. Robert K. Clay, Clerk, Virginia Villa, Worle.

Wrexham.—February 28th. Meters, carbon-filament lamps, oils, coal and boiler solution, for the Corporation electricity department. Borough Electrical Engineer, Willow Road.

CLOSED.

Belgium.—Seven German and three Belgium concerns submitted tenders last week to the Société Nationale des Chemins de fer Vicinaux, of Brussels, for the supply and laying of the underground and sub-river armoured electric cables required in connection with the supply of current to the local railway between Brussels and Haecht. The lowest offer was that of the Société A.E.G. Union Electrique, of Brussels.

Bexhill.—The Council has accepted the tender of Messrs. Pettet & Co. for 1,000 tons of coal (Shipley peas, Tibshelf peas, or Manners' Kilburn peas), at 18s. 10d. per ton.

Australia.—VICTORIA.—Postmaster-General's Department:—

78,000 pattern "A" porcelain insulators.—Webster & Co., Ltd.

WESTERN AUSTRALIA.

25 interior distributing boxes, 52 pairs, £1 7s. 3d. each; 25 ditto, 26 pairs, 18s. 9d. each; 100 ditto, 13 pairs, 13s. 6d. each.—Orde Powell.
60 tons galvanised iron wire, 400 lb. per mile, £10 6s. 2l. per ton.—Malloch Bros.

VICTORIA RAILWAYS DEPARTMENT.

Vulcanised rubber electric light wire.—Noyes Bros. (Melbourne) Pty., Ltd.
60-H.P. electric motor, &c., £140.—Australian Metal Co.
Two-ton "Lansden" electric vehicle chassis, £800.—Federal Storage Battery Car Co., Ltd. (in liquidation).

N.S.W. PUBLIC WORKS DEPARTMENT.

Six electric truck and goods lifts, £4,468.—Standard Waygood Hercules, Ltd.

SYDNEY MUNICIPAL COUNCIL.

Bare copper cable, £5,666.—B. I. & Helsby Cables, Ltd.—*Australian Mining Standard.*

NEW ZEALAND.—The Auckland City Council has accepted the tender of Messrs. Richardson, McCabe & Co., for overhead and V.I.R. cables, at £5,458.—*Tenders.*

Blackpool.—The Tramway Committee has awarded contracts for new uniforms to Messrs. Briggs, Jones & Gibson; for caps to Messrs. Donnelly & Sons; and for straw hats to Mr. J. Anderson.

Bury (Lancashire).—The Tramways Committee has placed a contract for clothing with Messrs. H. Lottery & Co., of London.

Great Yarmouth.—The Corporation has accepted the tender of the Brush Electrical Engineering Co., Ltd., for the supply of a 600-KW. turbo-alternator, at £3,530.

Grimsby.—The Electricity Committee has accepted the tender of Messrs. E. Bannister & Co., for Sherwood slack coal for nine months, at 6s. 4½d. per ton.

Harlech.—Messrs. Johnson & Phillips, Ltd., have secured the order for a complete plant for Harlech, including an oil-driven generating set, switchboard, accumulators and overhead lines for the public and private lighting supply.

Huddersfield.—The Corporation has accepted the tender of the Glasgow Railway Engineering Co. for steel tires and tram-car wheels.

India Office.—The India Office has accepted a tender from the Edison & Swan United Electric Light Co., Ltd., for Royal Ediswan lamps.

London.—HAMMERSMITH.—The B.C. Electricity Committee recommends that two 9-H.P. motors be purchased from the Langdon-Davies Motor Co., at £29 16s. each, for hire to W. A. S. Benson, Ltd.

The Committee recommends the acceptance of the following tenders for annual contracts:—

Pryke & Palmer.—Packing and jointing materials, and steam and gas tubes and fittings.
Wiggins & Co.—Firebricks, clay, lime, &c.
Glenboig Fireclay Co.—Glenboig firebricks, &c.
Timmins & Co.—Coke oven firebricks.
City Glass Co.—Arc lamp globes and lamp shades.
Chamberlain & Hookham, Ltd.—Ordinary and prepayment meters.
Electrical Apparatus Co., Ltd.—Ordinary meters.

For the supply of draw boxes the following tenders have been received:—

W. Lucy & Co.	£425
W. T. Henley's Telegraph Co. .. .. (recommended)	427
Sykes & Sugden, Ltd.	519
Johnson & Phillips	554
British Insulated Co.	559
Callender's Cable Co.	588
Siemens Bros & Co.	681
W. T. Glover & Co., Ltd.	1,192

BATTERSEA.—The B.C. has accepted the tender of Mr. W. Morgan, for the installation of arc and metallic lamps on consumers' premises.

The Metropolitan Asylums Board has accepted the offer of the Electrical Power Storage Co., Ltd., to maintain the storage battery on the training ship *Exmouth* for a further period of five years at an increased charge of £13 10s. per annum.

DEPTFORD.—B.C. The Library Committee reports the receipt of the following tenders for electric light fittings at the Central Library:—

Haycraft & Son	£81
Siemens Bros... .. .. .. (not to specification)	71
W. M. Williamson	84

The Committee has accepted Messrs. Haycraft's tender, as the wiring of the building is being carried out by that firm.

Lymington.—The T.C. has accepted the tender of Messrs. Crompton & Co., Ltd., for electrically-driven pumping plant at the sewage station, at £346.

New Zealand.—The Auckland Harbour Board has accepted the tender of Hawthorne & Co., £2,780, for the installation of an electric hauling slipway and winch.—*New Zealand Shipping and Commerce.*

Southampton.—The Corporation has placed a contract with the British Thomson-Houston Co., Ltd., for one year's supply of their type R. H. electricity meters.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, February 27th. At 8 p.m. At 39, Victoria Street. Paper on "Operation and Upkeep of Electric Motors," by Mr E. F. Butler. Saturday, February 28th. At 6.30 p.m. At Holborn Restaurant. Annual dinner.

Northampton Engineering College Engineering Society.—Friday, February 27th. At St. John Street, E.C. Paper on "The Forth Bridge," by Mr. H. J. Nichols.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, February 27th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General meeting.

Physical Society.—Friday, February 27th. At 8.30 p.m. At Imperial College of Science, South Kensington. Guthrie Lecture, by Prof. R. W. Wood, on "Radiation of Gas Molecules Excited by Light."

Royal Institution of Great Britain.—Friday, February 27th. At 9 p.m. At Albemarle Street, W. Paper on "Surface Combustion," by Prof. W. A. Bone, F.R.S.

Manchester Association of Engineers.—Saturday, February 28th. At Grand Hotel, Aytoun Street. Paper on "Mechanical Filtration," by Mr. A. J. Clark.

Batti-Wallahs' Society.—Saturday, February 28th. Annual Dinner.

Society of Engineers.—Monday, March 2nd. At 7.30 p.m. At Institution of Electrical Engineers, Victoria Embankment. Paper on "Esperanto: an International Language for Engineers," by Mr. T. J. Gueritte.

Wireless Society of London.—Tuesday, March 3rd. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment. General meeting. Debates on the "Design of Receiving Apparatus," opened by Mr E. Russell Clarke, and "The Relative Importance of Constructional Features of Telephones," opened by Mr. W. J. Fry.

Institution of Civil Engineers.—Tuesday, March 3rd. At 8 p.m. At Great George Street, S.W. Papers to be further discussed:—"Rail Steels for Electric Railways," by Mr W. Willox; and "Rail Corrugation and its Causes," by Mr. Stephen Sellon.

Institution of Civil Engineers of Ireland.—Wednesday, March 4th. At 8 p.m. At 35, Dawson Street, Dublin. Ordinary meeting.

Institution of Electrical Engineers (Students' Section).—Wednesday, March 4th. At 7.45 p.m. At Victoria Embankment. Discussions on "Synchronous v. Induction Motors," opened by Mr. H. K. Whitehorn, and "The Prospects of Electrical Engineers," opened by Mr. J. W. Kilby.

(Manchester Students' Section).—Tuesday, March 3rd. At 7.30 p.m. At Municipal School of Technology. Paper on "The Possibilities of Electric Traction on Railways," by Mr. J. L. Moffett.

(Scottish Students' Section).—Tuesday, March 3rd. At 8 p.m. At Royal Technical College, Glasgow. Paper on "The Maintenance and Repair of D.C. Plant," by Mr. H. A. Stewart.

Royal Society of Arts.—Wednesday, March 4th. At 8 p.m. At John Street, Adelphi. Ordinary meeting.

Royal Institution of Great Britain.—Thursday, March 5th. At 3 p.m. At Albemarle Street, W. Paper on "Heat and Cold," by Prof. C. F. Jenkin. Saturday, March 7th. Paper on "Recent Discoveries in Physical Science," by Prof. Sir J. J. Thomson.

Chemical Society.—Thursday, March 5th. At 8.30 p.m. At Burlington House, W. Ordinary meeting.

Greenock Electrical Society.—Friday, March 6th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Paper on "Power Transmission," by Mr. A. Zoller.

Junior Institution of Engineers.—Friday, March 6th. At 8 p.m. At 39, Victoria Street. Paper on "Maihak Indicator and Battcher's Power Counter," by Mr F. E. Rainey.

Nottingham Society of Engineers.—Friday, March 6th. At 7.30 p.m. At Welbeck Hotel, Milton Street. Annual Dinner.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION)

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, March 2nd.—"A" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Tuesday, March 3rd.—"B" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Wednesday, March 4th.—Recruits only. Infantry drill, 7 to 8 p.m. Technical instruction, 8 to 10 p.m. Rating examination for all Companies. 7 to 10 p.m.

Thursday, March 5th.—"C" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Friday, March 6th.—"D" Company. Technical instruction, 7 to 9.30 p.m. Miniature range practice, 7 to 9 p.m.

Saturday, March 7th.—Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

Institution and Lecture Notes.—BIRMINGHAM AND DISTRICT ELECTRIC CLUB.—Mr. W. Y. Anderson presided, on Saturday last, at the fifth annual dinner of the Electric Club. Responding to the toast of "The City of Birmingham," Mr. Chattock referred to the forward policy of the City Council in developing the electric supply undertaking, and said that the provision of a cheap supply of electricity for power purposes was vital to the progress of a great industrial centre like Birmingham. The price of electricity in Birmingham was among the lowest in the kingdom, and last year about 70 million units of electricity were generated in the city.

Physical Society of London.—At the annual general meeting on February 13th, the reports of the Council and treasurer were adopted.

The following is a list of officers elected for the ensuing year :—President : Sir J. J. Thomson, F.R.S. Vice-presidents : Prof. T. Mather, F.R.S., A. Russell, D.Sc., F. E. Smith, R. S. Whipple. Secretaries : W. R. Cooper, 82, Victoria Street, S.W. ; S. W. J. Smith, D.Sc., Imperial College of Science and Technology, South Kensington. Foreign Secretary : R. T. Glazebrook, F.R.S. Treasurer : W. Duddell, F.R.S., 56, Victoria Street, S.W.

Papers entitled "On the Moving Coil Ballistic Galvanometer," by R. Ll. Jones, M.A., and "On Vibration Galvanometers of Low Effective Resistance," by Mr. A. Campbell, were read. A paper "On Vacuum-tight Lead Seals for Leading-in Wires in Vitreous Silica and other Glasses," was read by Dr. H. J. S. Sand. The author has found that lead which has been allowed to solidify in contact with glass will, if free from oxide, form a vacuum-tight joint with the latter. Owing to the very great firmness with which the metal adheres, and owing to its great plasticity, these joints can stand temperature changes without damage. When applied to quartz, the joints are usually made inside a tube in conjunction with a molybdenum wire seal as follows :—The tube is shaped so that the molybdenum wire can be placed loosely inside it. A short piece of the latter is later sealed into the quartz, whereas one of its ends projects a few millimetres into the space in which the lead seal is to be made. Connected with this space by a short capillary there is an upper chamber in which the piece of lead is placed. The air is first blown out with hydrogen, and the tube then closed at the top and evacuated to a pressure of a millimetre or two. The quartz is then softened and pinched on to the molybdenum wire. After this the lead is melted and allowed to filter from oxide through the capillary and run into the space shaped to receive it, which has been highly heated. Before it has solidified, the tube is broken at the top to allow the pressure of the atmosphere to force the lead well against the surface of the glass. The tube is then cut at a suitable place and a tinned leading-in wire introduced into the lead. Such seals have been successfully fitted to vacuum tubes, mercury lamps, &c., and when made as described have so far not been known to fail. Prof. C. H. Lees asked how the cost of the process compared with that of the ordinary platinum seals in the case of glass. Dr. Sands, in reply, stated that platinum seals could be made with such small quantities of platinum that it was hopeless to try to compete with them in point of cheapness.

Institution of Civil Engineers.—At the meeting, on Tuesday last, a paper on "Rail-Steels for Electric Railways," was read by Mr. W. Willox, who said that the reduction of the life of rails in tunnels from an average of five years to less than three years, and in certain places to less than one year, on the electrified portion of the Metropolitan Railway, induced him to make tests of various kinds of steel rails in the curve between Farringdon Street and Aldersgate. The paper describes the results of these and other tests. The author has come to the conclusion that open-hearth basic Bessemer rails, manufactured by the late Mr. C. P. Sandberg's process, and under careful supervision, have proved the most economical. A paper on "Rail-Corrugation and its Causes," was read by Mr. Stephen Sellon. The author stated that investigations organised by many Associations in various parts of the world had not discovered a solution of the trouble, or propounded any theory of the causes which had found general acceptance ; nor had they put forward any remedy. Large expenditure was being incurred by many tramway undertakings in grinding out corrugations, thereby shortening the life of the rails abnormally. It was estimated by the general manager of the City of Glasgow Tramways that his undertaking spent not less than £10,000 per annum in this grinding operation. The author was of opinion that the rail-steel now used for rails was not hard enough or tough enough for its work. He believed that hard rails—*i.e.*, with a high proportion of carbon—were essential, and gave some evidence from his own and others' experience that such high-carbon rails resisted the corrugating actions of the wheels, as well as ordinary wear. At ordinary speeds the usual pitch of the corrugations on tramway rails corresponded with a frequency of the order of 100 per second. The evidence seemed to show that a comparatively small increase in the compressive strength of the steel would prevent the particular kind of wear under consideration. The British standard specification prescribed an ultimate tensile strength of 40 tons per sq. in. Probably steel with an ultimate tensile strength of 50 to 60 tons per sq. in. would be hard enough to resist the destructive stresses, but it was essential that it should not have a high degree of ductility.

Association of Mining Electrical Engineers.—A meeting of the General Council of the Association was held on February 7th at the Institution of Electrical Engineers, London, the President of the Association (Mr. Alexander Anderson) being in the chair. It was decided to hold the next Council meeting in London on July 4th next. The next examination for certificates of competency in mining electrical engineering will be held on March 14th and 21st simultaneously in about eight different centres in the United Kingdom. At the present time there are 128 certificated members on the register of the Association.

At a meeting of the West of Scotland Branch on Saturday last at Glasgow, discussion was resumed on a paper previously contributed by Mr. J. P. C. Kinlen, on "The Choice of Mining Electrical Machinery."

At a joint meeting of the South Wales Branches of the A.M.E.E and the Colliery Managers' Association at Swansea, the president, Mr. Lewis Watkins, of Bargoed, stated that his company had ordered 6,000 electric safety lamps. Mr. J. Glynn Williams read a paper on "Electrical Equipment for Low Energy Consumption."

At a joint meeting of the North Staffordshire Branches of the Colliery Managers' Association and the A.M.E.E at Stoke, the use of electric lamps in mines was discussed, and Dr. T. L. Llewellen stated that he hoped that by this means the eye disease known as miners' nystagmus would be eventually done away with. Mr. F. J. Turquand read a paper on the various types of electric lamp now on the market.

At a meeting of the Huddersfield Engineering Society, last week, a lecture was given by Mr. S. Simpson, of Bradford, on "Electrical Power : Its Production and Utilisation."

Institution of Electrical Engineers.—The annual dinner of the Yorkshire Section of the Institution was held at the Hotel Metropole, Leeds, on Friday, the 20th inst. The chair was occupied by Mr. W. B. Woodhouse, chairman of the Section, and there was a large company.

The loyal toast having been duly honoured, Mr. A. G. Lupton (Pro-Chancellor of Leeds University) proposed "The Institution of Electrical Engineers," and said the country owed a debt of gratitude to the Institution for the services which it had rendered to the electrical industry and to the whole community thereby and for the high standard of honour and uprightness which it had maintained. The President of the Institution (Mr. W. Duddell, F.R.S.) responding, said the Institution had done a great deal, but it had still more work to do, and he made an appeal to members of the Local Sections to help to increase its prestige. They hoped in the future to extend their usefulness, not only with reference to the driving of mills and factories, but also in connection with agriculture. Mr. Robert Hammond, who also responded, spoke of the remarkable development of electrical undertakings in South Africa in particular. As illustrating the general advance, he remarked that his first visit to Leeds to test a set of plant had been in reference to one of 7 kw., and he was so impressed with the importance of the occasion that he travelled first-class. In 1913 his own firm had dealt with a set of 7,000 kw. Whilst in South Africa recently he had been greatly struck with the progress of electricity in that country. In 1905 he had read a paper before the British Association at Johannesburg, and advocated the application of electric power in all the Rand mines, laying special stress upon the advantages of electrical winding. The idea had then been looked upon as ridiculous. On arriving at Vereeniging last year he had found a 40,000-kw. station with a transmission at 80,000 volts instead of his suggested 70,000 volts, and the works in which he was interested were being supplied at ·77d. per unit instead of his suggested ·7d. He had found 180,000 kw. installed ; of 60 Rand mines, 48 were electrically operated, and half of those had adopted electric winding with a power amounting to 70,000 kw. If that could be done on the Rand, it could be done in Yorkshire.

The Chairman, who proposed "Our Guests," spoke of the close association in the future between the development of electricity and coal and agriculture. Coal was nowadays found to be not merely a fuel, but also the source of a very valuable fertiliser, and a growing industry was that of the production of sulphate of ammonia from coal. He believed the future developments in Yorkshire would be even greater than those in South Africa mentioned by Mr. Hammond. The multiplicity of authorities was a source of difficulty ; in Yorkshire there were 50 authorities controlling electrical supply to a population of two millions, whilst in Chicago, with a similar population, the supply was handled by one company. The utilisation of electrical power would rid the farmer of his great bane, smoke, and give the agriculturist a convenient form of power for his own operations, and from the scientific and economical use of coal, the agriculturist would derive a valuable fertiliser. The chairman concluded by paying a tribute to the work done in Leeds by Mr. Harold Dickinson, who briefly responded to the toast.

Prof. G. F. Charnock, Principal of the Engineering Department of Bradford Technical College, proposed "The Electrical Industries." He showed their development by a series of tables. The capital invested in electrical companies and the money borrowed by local authorities for similar purposes in this country, he said, amounted to £435,000,000 in 1913, and the value of the units supplied had increased to £1,317,000,000. It had been proved that the lowest capital cost of installation and the maximum economy in coal consumption could only be obtained by the use of large generating units. The future would disclose interesting and important developments in the utilisation of waste gases from coke ovens, blast furnaces, &c., throughout the country, which would be more than sufficient to serve the existing public supply stations, assuming their combined output to be equal to 800,000 kw., and this could be done without using any coal. Prof. Charnock appealed for every encouragement for the young men of the industry, and pointed out that only good treatment in the matter of pay and other respects could produce good men to carry on the work for the benefit of the country. The toast was responded to by Mr. H. H. Wright, who reviewed the conditions of the industry in recent years.

Upon the motion of Mr. T. Roles, of Bradford, the toast of "The Chairman and Hon. Secretary" (Mr. J. D. Bailie) was honoured.

At the meeting of the Birmingham Local Section on Wednesday, a paper was read by Mr. F. Lydall on "Motor and Control Equipments for Electric Locomotives." The discussion was closed.

At the meeting of the Manchester Local Section on Tuesday last, Mr. R. T. Smith read his paper on "Some Railway Conditions Governing Electrification." The discussion was adjourned.

Greenock Electrical Society.—A paper on "Power Station Design" was given by Mr. J. Punch on Friday last, before a good attendance of members.

Association of Electrical Station Engineers.—A meeting was held at Bradford on February 19th, at which there was a

small but representative attendance. Mr. Eakin was in the chair. The meeting was in favour of the A.E.S.E. supporting the "Weekly Rest Day Bill." A resolution was passed condemning the insertion of a strike penalty clause in Power Supply Bills. The recent events in London were discussed, and the following resolution was passed:—"That this meeting expresses its confidence in the dealings of the London Executive Committee in view of recent events." A meeting was held at Birmingham recently, at which the members emphatically stated that the A.E.S.E. should proceed to obtain the objects of the Association by peaceful measures and not take action with any Trade Union; the Bradford and Manchester branches have also expressed similar opinions.

Institution of Mechanical Engineers.—The annual report, presented to the meeting on Friday last, states that the total membership has increased from 6,160 to 6,346 at the end of 1913. The total revenue for the year was £17,320, and the expenditure £13,633. The net capital of the Institution amounted to £67,924. The Benevolent Fund incorporated in September now amounts to £4,350.

Modern Methods of Welding.—That the future, in the field of welding, belongs to various electric and oxy-acetylene systems is the general conclusion to be drawn from a paper read recently by Mr. T. T. Heaton before the Institution of Mechanical Engineers. The technical details of these systems are now known almost as widely as the blacksmith's coke fire and hammer method. Electrical methods in extensive application fall into one or other of the categories arc welding and resistance welding, with the exception of the Strohmenger-Slaughter system, in which both arcing and contact resistance are operative. In Mr. Heaton's opinion, the Benardos arc system is the most generally useful method of electric welding, and acetylene the best blowpipe gas. Other electric systems, and possibly other fuel gases, are applicable to special work. Delicate adjustment as to time and current is required in contact-welding systems; skilled labour is, indeed, essential to success, whatever the electric or gas welding system employed, and insufficient attention is frequently paid to the design and arrangement of pieces to be joined, in such manner as to avoid internal contraction stresses on cooling. Owing to its lower temperature, the oxy-acetylene flame is better than the electric arc for welding thin material, since the risk of burning is not so great in the latter case. In general, however, electric welding is more rapid and effective, since heat is produced within the work itself. In any case, the character of the metal at the weld is changed to some extent, but the loss in ductility and strength is far less than occurs in a blacksmith's weld, particularly if the electric or gas weld be subjected to suitable mechanical and thermal treatment before being placed in service. Many tests have shown that 89 per cent to 96 per cent. of the original strength of metal can be relied upon in an electric weld. It has been said that the Benardos system yields unsatisfactory results by loading the weld metal with carbon; this only occurs if the manipulation is faulty, the polarity wrong or the metal never of properly weldable quality.

In the course of the discussion on the above paper, Mr. Clarkson (National Steam Car Co.) expressed himself as disappointed with oxy-acetylene welding which, he said, did not bring metal to a plastic condition permitting the pieces to be forced together to form a homogeneous joint. He exhibited a motor-bus wheel which demonstrated clearly the extreme utility of the electric resistance process. The nave was a drop forging made with eight radial bosses, which were turned externally and bored internally to form tubes of exactly the same section as the drawn steel tubular spokes. The latter were butt-welded on to the hub bosses by the electric contact resistance method, and bell-mouthed rim attachment flanges were then secured to the outer ends of the spokes by the same method. After machining the rim flanges, the pressed steel rim was shrunk on. The whole construction is exceptionally light, and every spoke is tested to 5 tons, though the normal maximum load on the wheel does not exceed 30 cwt. The spoke tubes, when cut longitudinally, opened and flattened, will stand bending through 180° at the weld without failure of the latter. Mr. Clarkson contended that no acetylene weld would stand this treatment, and that though acetylene welding was satisfactory for many purposes, and particularly for tension joints, it could not be relied upon where bending was to be resisted. This contention was disputed by other speakers, and it appears likely that some interesting demonstrations will be arranged. Mr. Richardson stated that the average proportion of oxygen and acetylene used by the nine best makes of welding torches in this country was 1·26 : 1·0. This did not agree with the 1·5 : 1·0 ratio recommended by the author. The ideal—realised where high-pressure torches and dissolved acetylene were used—was a 1 : 1 ratio. The advantage was emphasised of using constant-current dynamos in the Benardos system, to maintain practically constant flow from short circuit up to a 4-in. or 5-in. arc, meanwhile eliminating all regulator loss. The numerous examples illustrated by the author, and quoted by speakers in the discussion, demonstrated the vast present importance, and almost universal applicability, of modern welding systems.

Electrolytic Corrosion of Iron in Soils.—In No. 25 of the *Technologic Papers of the Bureau of Standards*, U.S.A., Messrs. B. M Collum and K H. Logan give details of an extended research on this subject. The following are some of the conclusions drawn from the experimental data presented.

The current density has a marked effect on efficiency of corrosion of iron in soils, the efficiency of corrosion being, in general greater the lower the current density. In saturated soils the corrosion may vary between 20 per cent. and about 140 per cent. for the range of current densities between 5 milliamperes and 0·05 milliampere per square centimetre.

Moisture content in the soil also has a marked effect on efficiency of corrosion, the corrosion efficiency being in general greater with increasing moisture content up to saturation of the soil. Beyond this point increased moisture content has comparatively little effect.

Temperature changes within the limits commonly met with in practice have no important effect on corrosion efficiency.

The depth of burial of pipes has no direct effect on corrosion efficiency, provided other conditions remain constant.

The amount of oxygen present has a marked effect on the end products of corrosion. If the corrosion is rapid and the supply of oxygen small, there will be a preponderance of magnetic oxide, while if the rate of corrosion is low and the supply of oxygen abundant, the ferric oxide will predominate. Owing to the fact that the supply of oxygen around pipes buried in earth is always more or less limited, the character of the oxides formed gives some indication as to the rate of corrosion, and thus indirectly the cause of the corrosion, if local conditions are properly considered.

There is no material difference in the efficiency of corrosion shown by the various kinds of iron commonly used in the manufacture of underground pipes.

The fact that a given chemical tends strongly to inhibit either self-corrosion or electrolytic corrosion in liquids is no indication that it will materially retard electrolysis of iron embedded in soils.

The efficiency of corrosion was found not to be a function of the voltage except in so far as the current density may be affected. Voltages as low as 0·1 and 0·6 volt showed practically the same efficiency of corrosion as 5 to 10 volts or higher. Corrosion efficiencies between 50 and 110 per cent. may usually be expected under most practical conditions.

The resistance of soils varies throughout a very wide range with variations in moisture content, the resistance of comparatively dry soil being of the order of several hundred times the resistance of the same soil at about saturation. Above saturation, increase in moisture content has but little effect on the resistance of the soil. Because of the great variations in resistance of earth with moisture content, voltage surveys should not be made at times when the earth is extremely dry.

The resistance of the soil varies greatly with temperature within the ordinary range encountered in practice. At about freezing temperature the resistance will be several times that at summer temperatures. This not only has an important bearing on the magnitude of the electrolysis trouble that may occur at different seasons, but also indicates that where practicable, voltage surveys should not be made when extremely low temperatures prevail.

The experimental results given in this paper have an important bearing on the subject of electrolysis mitigation through the limitation of voltage drop in the negative return. For some years the chief means of preventing trouble from electrolysis in certain countries has been the limitation of the permissible voltage drop between any two points on the return circuit. In some places the limit has been placed on the maximum voltage during peak load, whereas in other cases the average voltage for 24 hours has been the determining factor. It appears from the data presented in this paper that the rate of damage does not increase as fast as the voltage increases, because of the tendency toward lower corrosion efficiencies at higher current densities. This indicates that, with a given average all-day current, the actual amount of electrolysis that would occur would be less with a bad load factor than with a good load factor, and hence points to the undesirability of penalising a high peak of short duration. It would appear more logical, therefore, in so far as the damage itself is concerned, to make the average all-day voltage the basis of the limitation rather than the voltage at time of peak load.

Air-Brake Tests.—Important improvements in the braking of heavy passenger cars were to be described in a paper read before the American Society of Mechanical Engineers on February 10th, by Mr. S. W. Dudley, of Pittsburg. These tests were conducted jointly by the Pennsylvania Railroad and the Westinghouse Air-Brake Co. The results are considered the most important recent contribution to the subject of air-brakes. A train of 21 steel cars travelling at 60 miles per hour stores up 224,000,000 ft.-lb. of energy. This is sufficient to raise the entire train 120 ft. With prevailing brake equipment such a train would be stopped by an emergency application in a distance of 1,600 to 2,200 ft., according to the truck rigging and brake shoe design. These tests showed that this distance has actually been reduced to 1,000 ft. or to within the length of the train. The improvements centre in the electric control of the brakes, giving quick, simultaneous and responsive action. The tests constituted a progressive development of brake rigging and brake shoes in connection with the scientific study of the air-brake as a whole.

Appointments Vacant.—Superintendent of telephones and foreman of electric light, for Dominica Government (£200, travelling expenses, free passage); chief traffic inspector (47s. 6d. to 50s.), and switchboard attendant (20s. to 25s.), for Erith Electricity and Tramways Department. Particulars are given in our advertisement pages.

Patent Restored.—An order has been made restoring Patent No. 5,522 of 1907, granted to James Hawley, Ltd., and Albert Savory Jones, for "An Improved Electro-Magnetic Separator Drum for Grain and Similar Conveyors."

Electrical Wages in Australia.—According to the *Sydney Herald*, Mr. H. Montgomerie Hamilton, chairman of the Government Tramways Group, No. 4 Board, has issued an award (for three years) dealing with the electrical trades. The main provisions include the following :—

The minimum rates of pay for the following classes of labour shall be :—Electrical fitters, 12s. per day ; armature winders, 10s. (and bonus) ; electrical testers and running testers, 12s. 6d. ; power signal electricians, 11s. 6d. when not in charge of a squad ; men in charge of a squad shall receive 12s 6d. ; battery mechanics, 12s. ; electrical mechanics, 11s. ; electrical mechanics when engaged on battery work shall receive 1½d. per hour extra ; arc lamp trimmers, 9s. 6d. ; leading hands shall receive 1s. 6d. per day over their usual journeyman rate ; apprentices, 10s., 15s., 20s., 27s. 6d. and 30s. per week for the first, second, third, fourth and fifth years respectively.

Forty-eight hours shall constitute a week's work for all employés engaged on day work, and the working hours are to be between 7.30 a.m. and 5 p.m. on five days of the week, and between 7.30 a.m. and 12 noon on Saturday. All time worked in excess of the ordinary hours of labour is to be paid for at the rate of time and a half. All work done on Sundays and public holidays, and on Christmas Day and Good Friday, in all cases where men are not allowed a day off in lieu of such days, is to be paid for at the rate of time and a half.

When either an electrical fitter or mechanic is required periodically to take a shift on maintenance work he is to be allowed 1s. extra per shift, provided three-quarters of such shift is worked outside the ordinary working hours. Country work is work performed outside of a limit of 25 miles from the workshop to which an employé is attached. Travelling time is to be allowed to and from such place of employment, but is not to be paid for in excess of eight hours for any 18 hours travelled.

Railway electricians.—Wages, 70s. per week for the first year ; thereafter 80s. When away from home station, railway electricians shall be allowed the following expenses : Nine hours, 2s. ; 12 hours, 4s. ; 18 hours, 5s. 6d. ; 24 hours, 7s.

Wages in the power house and sub-stations include the following :—Power-house shift electricians, D.C. boards, 14s. ; A.C. board, 15s. ; sub-station shift electricians, 11s. 8d. for the first six months ; thereafter 12s. 8d., 13s. 4d. and 14s. ; shift electricians while in charge of construction staff, 1s. extra ; shift electricians while employed on instrument maintenance, 14s. ; shift electricians while employed on general sub-station maintenance, 13s. 4d. ; assistants on A.C. switchboard (power house), 9s. ; dynamo attendants, 10s. 6d. ; compressor house electricians, 12s. ; battery attendants, 8s. 6d. ; shift electricians, country and suburban generating stations, 12s. 8d. ; senior shift electrician (Clyde), 13s. 8d. ; six eight-hour shifts will constitute a week's work. All time worked in excess of eight hours is to be paid for at the rate of time and a half.

The Patents and Designs Act.—The Manchester Chamber of Commerce has issued a pamphlet in reply to arguments used by the Council of the Chartered Institute of Patent Agents regarding a resolution of the Chamber of Commerce, urging that, in view of the fact that Mr. Justice Parker's comments in Hatschek's case, in the year 1909, as to the extent of the onus devolving upon any applicant who seeks revocation of a patent for non-working under Sec. 27 of the Patents and Designs Act, 1907, have deprived that section of its effectiveness, the rules be amended in such terms as will place the burden of proof on the patentee—an effect which was the object of those who drafted the Act in 1907.

Prior to the ruling of Mr. Justice Parker, any applicant for revocation of a British patent could call upon the patentee to prove that he, the patentee, was not manufacturing the patented article, or carrying on the process exclusively or mainly outside the United Kingdom, while now, by the ruling of Lord Parker, the applicant must, with his application, leave at the Patent Office evidence by way of statutory declaration stating the particulars upon which he relies in support of his allegations. Lord Parker's decision, says the Chamber of Commerce, has practically annulled the benefits that had, prior to his decision, been brought about—owing to the compulsory working clauses of Sec. 27.

The pamphlet states that Sec. 27 undoubtedly had, and still has, the warm approval and support of the great majority of the trading and industrial community of this country. Opposition to it is confined almost exclusively to certain patent agents and lawyers.

A trader who applies to the Railway Commissioners for a lower railway rate is entitled to call upon the railway company to prove that the rate demanded by them is a reasonable one. In the same way, the Manchester Chamber considers it perfectly reasonable that it should be for the patentee to prove that he is carrying out his part of the bargain with the State when he is called upon to do so. Only a *bona fide* interested party should be allowed to make an application for revocation. It should be considered that he has made out a *prima facie* case if he declares on oath that he has made every legitimate endeavour to discover to what extent, if at all, the patent is being worked in this country, and how far there is importation of the patented article, if any.

The question of compulsory working is a commercial and an economic one, very little appreciated by most lawyers and patent agents, and the commercial and industrial community strongly favours compulsory working of patents quite independently of any political party questions. The Act came into force on January 1st, 1908, and there has so far been no retaliation worth considering. It is quite erroneous to contend that an English patentee, in order to maintain his foreign patents in those countries where compulsory working is enforced, must erect a factory, for the grant of licenses to manufacture is quite sufficient to meet the demand of the patent laws of such countries.

The Chamber adds that the patent which is not worked in this country, but worked abroad, frequently becomes a permanent monopoly, because at the expiration of the patent there are no skilled workmen, foremen, managers, and others acquainted with the details of the manufacture of the patented article, and there is no organisation for selling the products which have been the subject of the patent for many years. If the patent be worked here, there are many advantages to British trade and industries ; work is found for British workpeople, the new industry creates further industries and helps collateral existing ones. As examples of new industries thus created, the case of the "Otto" gas engine, the "Heilmann" cotton combing machine, and the soda process worked by Messrs. Brunner, Mond & Co., Ltd., are cited. "The question of the working of patents is of the greatest moment, *because* we are a Free Trade country, and is of correspondingly less importance to countries with high tariffs."

The reply of the Chamber concludes by pointing to a number of industries introduced during the short time of 14 months that Sec. 27 was really effective, including the manufacture of Diesel engines and metallic-filament electric lamps, as well as to the numerous cases in which English manufacturers have been appointed licensees to work British patents by foreign firms, in order that the latter might comply with the terms of the Patent Act.

Calcium Carbide.—The world's production of carbide of calcium reached about 300,000 tons in 1912. This progress is due less to the more extended use of acetylene than to the extension in the manufacture of cyanamide. Germany is the greatest consumer of carbide in Europe. Her imports in 1912 were 47,984 tons ; in 1911, 36,943 tons. Exports in 1912, 970 tons ; in 1911, 2,147 tons. The German consumption is advancing rapidly, and exceeds that of the United States. The autogenous welding of metals is responsible for a noteworthy portion of this consumption, which has now risen to 55,900 tons. In Sweden the carbide works operate for the production of cyanamide, and the Odessa establishment is equipped for an out-turn of 80,000 tons of carbide destined for this fertiliser. Very little carbide is exported from Sweden. Norwegian exports are expanding in a remarkable manner, to meet more particularly the huge demand from Germany ; they have almost doubled in four years, rising from 36,895 tons in 1908 to 64,000 tons in 1912. In the United States, exports touched 16 000 tons in 1912, against 13,000 tons in 1911. Shipments were directed mainly towards South America and Central America, where the consumption for private lighting has reached such a pitch as to induce the erection of works for its manufacture on the spot. Switzerland exported carbide in 1912 to the value of 5,500,000 fr. In 1910 the imports were 176 tons and the exports 24,105 tons ; in 1911 imports stood for 161 tons and exports 24,272 tons. In Austria-Hungary, imports in 1911 and 1912 were practically nil ; but exports were, in the same years, 11,729 tons and 10,820 tons. In England, imports totalled 14,000 tons in 1911 and 18,857 tons in 1912. Italy exported to a value of 12,200,000 lire in 1912 ; in 1911 the exports were 8,400 tons against imports of 7 tons only. The local production is utilised to manufacture 20,000 tons of cyanamide per annum. In France the imports during the years 1910, 1911 and 1912 were respectively 445, 2,162 and 3,302 tons ; the exports : 4,824, 5,058 and 6,225 tons. There is a steady increase in the exports to the French colonies, owing to the extension there of acetylene lighting.

Physical Exercises for Engineers.—On Monday Lieut. Müller is giving a demonstration of his system of physical exercises before the combined staffs of the Marylebone Electricity Supply Department and Messrs. Selfridge & Co. This is considered a very special favour, as Lieut. Müller has given up personal demonstrations.

Electrical Trades Benevolent Institution.—The chairman of Committee, Mr. Justus Eck, informs us that at the present time a strenuous effort is being made by the friends of the above institution to secure a handsome collection, to be announced as an addition to the funds at the annual Festival on March 25th. That the institution has justified its existence is beyond doubt ; during the year 1913, despite the activity in electrical circles the demand for relief was twice that of the previous year, and it must inevitably increase. Membership is becoming of added importance, and it cannot be too earnestly impressed on all those engaged in the electrical trade in the United Kingdom, whether as employers, managers, teachers, or on the engineering, designing, drawing, sales or office staff, or in any other similar capacity, that they should qualify as members without delay.

Membership is secured to qualified persons by a payment of 10s. in each year, payable in one sum or by small amounts monthly or weekly. Many of the members, however, contribute sums in excess of this, £5 being not at all unknown. Contributions of this kind as well as other are collected by authorised holders of collection books, who receive rewards for their work in the form of free membership and votes in proportion to the amount of their collections.

We cordially endorse Mr. Eck's appeal to all firms in every branch of the electrical industry in the United Kingdom, if unable to collect themselves, to nominate one or more members of their staffs willing to become active collectors. Prompt application to the secretary of the Electrical Trades Benevolent Institution at 18, Park Mansions, Vauxhall Park, S.W., will enable even the new collectors to report results before the next Festival.

We have great pleasure in announcing that Sir David Salomons, Bart., M.A., M.I.E.E., has accepted the position of president of the Electrical Trades Benevolent Institution, which became vacant on the death of Sir William Preece. With Sir David as president, and Mr. H. Hirst as chairman of the coming annual dinner, there should be a successful year before the fund.

In their report for the year ended December, 1913, the Committee state as follows :—

"The year 1913 will be remembered as the date of the inauguration, with most gratifying financial results, of the system under which heads of large electrical firms preside at the annual festival dinners. The total income was £1,300, which is a larger amount than has been received in any previous year. The subscriptions from members have increased, and the donations were £835, as compared with £512 in 1912. The result of the year's work has been a net income of £1,116. Of this amount, together with £150 which was placed on deposit at the bank at the end of 1912, £719 has been invested in New Zealand 3½ per cent. inscribed stock, and £383 in Metropolitan Water Board 3 per cent. stock, bringing the total of the invested funds to £4 920. It should be specially recorded that donations were received from the Electrical Contractors' Association, and for the fifth year in succession from the Electrical Engineers' Ball, and the second year in succession from the Garrick Dramatic Society. It may be noted with satisfaction that the total working expenses in 1913 were slightly less than in the previous year, the percentage of expenses as compared with the amounts collected being considerably less. The system of collectors' books came into full operation in 1913, and a list of the collectors, together with the amounts collected, is shown for the first time in the year-book of the Institution. The total amount collected by this means was £350.

"The Committee again wish to draw the attention of firms in the electrical industry to the great desirability of appointing as collectors some of the members of their staff, as the subscriptions of members of the Institution can be paid to such collectors by instalments, while subscriptions and donations can be obtained from other persons and firms with advantage to the collector.

"The total amount of the grants for 1913 was more than double that in 1912, which in turn was more than double that for the previous year. This demonstrates the need and utility of the Institution, and as it is becoming better known year by year, the calls upon it are bound to continue to increase rapidly."

The income for the year, including dividends on investments, subscriptions and donations, and sale of dinner tickets, totalled £1,363, and the expenditure was as follows :—Printing, &c., £57 ; secretary's salary and commission and office expenses £130 ; 14 grants made, £154 ; cost of annual festival £60. The balance carried to balance-sheet was £962. The investments of the fund now stand at £4,920. We should like to see that figure doubled or trebled straightaway, but at present it seems that the process of gradually building up the capital account will have to be continued. Therefore, we would urge all of our readers to do their utmost just now to assist the movement.

Parliamentary.—*London United Tramways Bill.*—The company are objecting to the petitions of the London and South-Western Railway Co., the Railway Carriage and Wagon Builders' and Financiers' Parliamentary Association, and the Middlesex County Council.

Lurgan Gas and Electricity Bill.—Mr. Moore has given notice of his intention to move the rejection of this Bill in the House of Commons.

London Electric Supply Bill.—Notices have been given by Messrs. Lough, Radford, Wiles and Dickinson, and Sir Stephen Collins, of their intention to move the rejection of this Bill.

Telephone Charges.—The Postmaster-General, in reply to Mr. Goldman, says he hopes to be able to announce the proposed new telephone rates before Easter.

Smoke Prevention.—Last week Mr. G. B. Burnside gave a lecture at Glasgow on experiments which he has carried out on the precipitation of smoke and fog at the University. The use of charged electrodes suffers from various drawbacks ; but excellent results have been obtained with damp steam electrically charged by friction in passing through nozzles, as in Lord Armstrong's experiments. The vapour, directed into a chimney, provides charged nuclei upon which the soot particles collect, with the result that the aggregates thus formed are precipitated by gravitation.

Sheffield Engineers' Demands.—Men employed in the engineering trades in Sheffield are making demands for more wages and shorter hours. The five years' agreement between masters and men will expire at the end of this month, and the men are asking for 5s. per week advance all round, a 48-hour week, and restriction of overtime. The engineers are at present receiving 39s., pattern-makers 41s. and 42s., steam engine makers and blacksmiths 39s. The question affects 9,000 men.—*Financial Times.*

Electric Roller Skates.—It is reported that a young American named Bruce Eytinge has applied electric motors to roller skates, and with the aid of a pair of batteries weighing 20 lb. is propelled without effort other than that required for steering.

Radium and Cancer.—An American authority on the treatment of cancer with radium, Dr. Robert Abbe, states that the beta rays, which have hitherto been considered dangerous, have a more powerful effect upon cancerous growths than the gamma rays, which have been relied upon until now.

Apparatus for Winding Electrical Machines.—An ingenious system of winding the stators of induction motors and similar machines has been brought to our notice by Mr. Geo. de-Curtis, of the British Thomson-Houston Co., London. Hitherto there has been no means of avoiding or shortening the tedious process of threading the wires repeatedly through the interior of the core and through the very narrow spaces between the end connections of the coils already in position ; the insulation of the wire may suffer considerable injury during the process, especially when, as is often the case, it is allowed to come in contact with the floor. Mr. de-Curtis's method, however, not only shortens the time occupied by 50 per cent., but also greatly diminishes the risk of abrasion of the insulation, and entirely avoids injury to the wire through contact with the floor. The apparatus required is extremely simple, and easily made in any workshop.

As the device is not at present covered by letters patent, we are unable to give further details at the moment. Mr. de-Curtis, however, will be pleased to answer inquiries from would-be users, addressed to this office.

Inquiry.—Makers of bakers' electric ovens are asked for.

The Brighton Railway Electrification.—Speaking at the meeting of the London, Brighton and South Coast Railway on Wednesday last, the Earl of Bessborough stated that the company were pushing on with the electrification of additional suburban lines, and hoped to have the section from Balham (the junction with the Crystal Palace electrical line) through Streatham Common to West Croydon and Wallington completed by the end of the year and in use by the following spring. The other sections would follow, and, it was expected, be completed within four years from now. Since the establishment of the existing electrical services, four years ago, they had carried an average of over six million passengers per annum in excess of the last year of steam operation.

The policy of electrification of the company's suburban services had been the means not merely of arresting the serious diminution of traffic arising from the competition of electric tramways and motor-buses, but of regaining all that had been lost and obtaining an increase on that. The whole of the alterations consequent on the adoption of electrical working had been made by their own officers and staff.

Last year the speaker, with his principal officers, had inspected various electric railways on the Continent, and it was gratifying to find that the single-phase system, which they had installed on the advice of their consulting engineer, Mr. Philip Dawson, was becoming the most favoured one. He understood that the Swiss Federal Railways had decided to adopt it on the extensions of the St. Gothard line.

The Electrical Engineers' Ball.—Nearly 300 votaries of terpsichore enjoyed a delightful evening at the Hotel Cecil on Friday last ; indeed, the opinion was universal that the scene of revelry by night had never been surpassed in any of the preceding gatherings. The hon. secretaries are to be heartily congratulated on the success of their untiring labours ; and as for the two hard-working but lightly-thought-of supper stewards—well, they will probably get their reward in the next world ; the dancing stewards got theirs at the time !

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. LESLIE FLOAT, of the Townmead Electricity Works, Fulham, has been appointed as a switchboard attendant at the Corporation Electricity Works, Gunwharf Road, Portsmouth.

The Warrington Corporation electricity staff have presented a rosebowl to MR. E. FENTON, a member of the staff, on his departure to take up an appointment in Yorkshire.

Tramway Officials—The L.C.C. Highways Committee recommends the following annual revisions of tramway department staff ; MR. J. WELLING, permanent way engineer, increase from £575 to £600 a year ; MR. A. R. OWEN, tramways and marine claims superintendent, increase from £500 to £550 a year ; MR. W. E. IRELAND, rolling stock superintendent, increase from £500 to £525 (an assistant rolling stock superintendent is to be appointed) ; MR. H. S. MAY, on his appointment as assistant rolling stock superintendent, increase from £300 to £325 a year ; MR. H. T. HIDER, assistant in the third class, increase from £180 to £190 a year ; MR. G. POTTER, assistant in the fourth class, Section (*a*), increase from £140 to £150 a year. Special-duty pay is to be granted to MR. R. G. THOMAS, assistant in the first class, £25 ; and MR. G. H. BROOKS, assistant in the third class, £10. The Committee also recommends that the salaries of MESSRS. C. H. PARDOE, S. R. GEARY, A. C. BOND, W. W. KINTON and A. H. BOGGIS, officers of the fourth class Section (*a*) tramways department, be increased to £120 a year ; and that MESSRS. H. J. JACOBS, O. WEICK, H. E. A. O.

TILLEY, C. H. TOWNSEND, S. H. STEEL, D. E. G. QUELCH, C. R. E. OSMOND, M. A. MOSS, W. J. LIAS, J. LEATES, N. LAWSON, J. H. HUTCHINGS, F. W. HUBBARD, A. HODGE, F. HARRIS, W. N. HALLIWELL, H. J. T. HALES, J. HADLOW, G. A. GASCOINE, F. FRENCH, E. A. FOLEY, C. H. FITCH, H. T. DENE, B. DAVIES, P. S. DAVENPORT, H. H. BURGUM, W. BEST, A. S. BARNES, B. T. ANDERSON, and H. H. STOLLERY, assistants in the fourth class Section (*b*) be advanced to Section (*a*) at the commencing salary of £120; and that MESSRS. W. E. BARNES, C. A. P. NETZ, W. J. PLATT, H. J. R. MARSON, T. W. BROWN, D. C. BROWN, E. H. R. BANKS, H. ALLEN, and S. SHACKELL, assistants in the fourth class Section (*b*) be advanced to Section (*a*) at a commencing salary of £110 a year.

MR. R. F. DIXON, of the Hull Corporation tramways department, has been recommended from among 91 applicants for the post of works superintendent in the Southampton Corporation tramways department.

At the Doncaster tramway offices recently Mr. E. S. Rayner, borough electrical engineer and tramways manager, presented, on behalf of the Tramway and Electricity Departments, a marble clock and pair of bronzes to MR. J. BROWN, who has vacated the the post of traffic inspector at Doncaster. Mr. Rayner congratulated Mr. Brown on having obtained the position of traffic manager to the Ayr Corporation Tramways. Mr. G. A. Roberts (assistant engineer), Superintendent Strachan, Inspectors Baker and Teal, and motorman Maw also made reference to Mr. Brown's abilities, and wished him success. Mr. Brown suitably responded.

At a smoking concert under the auspices of the Aberdeen branch of the Amalgamated Association of Tramwaymen, MR. WM. JOYNER, president, and MR. DAVID PATERSON, treasurer, were presented with gifts as tokens of their fellow-members' esteem.

General.—The Postmaster-General has appointed MR. G. F. MANSBRIDGE to be Assistant Controller of the Stores Department, G.P.O.

MR. T. J. GILTINAN has been elected instructor in wireless telegraphy for the Cork Technical Instruction School.

We are informed that MR. R. H. WILLIS has resigned his position as general manager of the British Electric Plant Co., Ltd., in order to commence business on his own account as an electrical and mechanical engineer and merchant at 211, Produce Exchange, Manchester, where all communications should now be addressed.

MR. A. J. WRAY, who has for nearly 12 years been manager of the Banbury and District Electric Supply Co., Ltd., was last week presented by the staff with an engraved brass inkstand, on his leaving for Kidderminster.

MR. C. MCKINLAY is resigning his position as manager of the electrical showrooms for Messrs. Falk, Stadelmann & Co., Ltd., Farringdon Road, E.C., having been appointed the London representative for the Carron Co. in connection with the sale of their electrical cooking and heating apparatus. Mr. McKinlay is also representing the Carron Co. in the South of England.

Obituary.—MR. E. L. MOULTON.—The death is announced of Mr. Edward Lavender Moulton, who was for many years the proprietor of the business now carried on at 35, High Street, Bedford, by Messrs. Bacchus & Ison, electrical engineers. Mr. Moulton was 77 years of age, served on the Town Council for a long period, and was Mayor of the borough in 1903 and 1908.

The death is announced from Vienna, at the age of 86 years, of PROF. DR. ADALBERT V. WALTENHOFEN. The deceased was the oldest electrical engineer in Austria, and was one of the founders of the Austrian Electrical Engineers' Association.

The death occurred, on 16th inst., of MR. A. L. GILLESPIE, electrical engineer, Dunmanway. Mr Gillespie, who was only 23 years of age, went over from Newcastle-on-Tyne three years ago to take up the electric lighting contract of the town of Dunmanway, Co. Cork, for the Rural District Council.

NEW COMPANIES REGISTERED.

City School of Wireless Telegraphy, Ltd. (134,059).—This company was registered on February 19th, with a capital of £1,500 in £1 shares, to take over the business of a school for wireless telegraphy carried on by J. R. Halliwell at 43, Thomas Street, Shudehill, Manchester. The subscribers are:—J. R. Halliwell, 43, Thomas Street, Manchester, electrical engineer, 50 shares; R. B. King, Holmleigh, Waterpark Road, Broughton Park, Manchester, traveller, 100 shares; J. Taylor, 154, Grange Avenue, Werneth, Oldham, secretary, 100 shares; R. Scott, Whitestones, Chapel-en-the-Frith, wire-rope manufacturer, 200 shares; L. Hitty, 73, Oak Road, Crumpsall, Manchester, manager, 100 shares; T. Rushworth, Tabley Villa, Bennetts Road, Crumpsall, Manchester, bristle merchant, 100 shares; J. D. Jeremiah, Ennismore, Lindon Road, Didsbury, company director, 100 shares; A. Chapman, 46, Thomas Street, Manchester, merchant, 125 shares. Private company. J. R. Halliwell is the first managing director, and may retain office while holding £200 shares; remuneration, £104 per annum and 20 per cent. of the net profits. Solicitors, Bond & Son, 19, Dickinson Street, Manchester.

Prentice Wireless Train Control, Ltd. (134,096).—This company was registered on February 20th, with a capital of £30,000, in £1 shares, to acquire rights in the Prentice automatic system of wireless train control, and the benefit of certain inventions and patent rights relating thereto and to signalling apparatus, &c. The subscribers (with one share each) are:—G. A. Phillips, 51, Bishopsgate, E.C., member of Stock Exchange; G. M. Miles-Bailey, J.P., Abbess Grange, Stockbridge, Hants.; F. W. Prentice, 45, Cranley Gardens, Muswell Hill, London, N., electrical engineer. Private company. The number of directors is not to be less than three or more than five; the first are G. A. Phillips, G. M. Miles-Bailey, J.P., and F. W. Prentice. Registered by Bristows, Cooke & Carpmael, 1, Copthall Buildings, E.C.

Midland Electric Rotary Blowing Co., Ltd. (134,088).—This company was registered on February 19th, with a capital of £1,000 in £1 shares, to carry on the business of electric organ blower makers and engineers, as formerly carried on by D. Cameron, at 42 and 44, Traffic Street, Derby, as Midland Electric Organ Blowing Co. The subscribers (with one share each) are:—C. Harvey, Beaulieu, Shoal Hill, Cannock, secretary; M. Harvey, Beaulieu, Shoal Hill, Cannock, hardware manufacturer. Private company. The number of directors is not to be less than two or more than five; the first are C. Harvey and M. Harvey (both permanent); qualification, 100 ordinary shares. Solicitors: Enoch Evans & Son, Walsall.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Wellingborough Electric Supply Co., Ltd.—Issue on February 3rd, 1914, of £1,500 debentures, part of a series of which particulars have already been filed.

Renton Holdsworth & Co., Ltd.—Resolution, charged on freehold lands and premises in Norfolk Street and Sycamore Street, Sheffield, dated January 29th, 1914, to secure all moneys due, or to become due, from company, to Williams Deacons Bank, Ltd.

Napier-Kimber, Ltd.—Issue on February 4th, 1914, of £100 debentures, part of a series of which particulars have already been filed.

Worcester Electric Traction Co., Ltd.—Mortgage, dated February 12th, 1914, to secure £1,000, charged on certain lands in Worcester. Holders: Worcester and Malvern Steam Laundry and Carpet Beating Co., Ltd., George's Square, Worcester.

Woking Electric Supply Co., Ltd.—Issues on various dates from July 13th, 1912, to December 29th, 1913, of £3,160 debentures, parts of a series of which particulars have already been filed. A memorandum of satisfaction to the extent of £2,800 on various dates from June 17th, 1913, to December 30th, 1913, of trust deed dated March 1st, 1906, securing debenture stock for an indefinite amount, has also been notified.

James Keith & Blackman Co., Ltd.—Issue on February 9th, 1914, of £5,000 debentures, part of a series of which particulars have already been filed.

Rugby Lamp Co., Ltd.—Issue on February 7th, 1914, of £100 debentures, part of a series of which particulars have already been filed.

Naylorgraph, Ltd.—Fourth debenture dated February 6th, 1914, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital (if any). Holders: J. M. Hunt, Fairlawn Park Road, Southborough, Kent.

Keynsham Electric Light and Power Co., Ltd. (64,034).—Capital, £5,000, in £1 shares (3,000 pref.) Return dated December 29th, 1913. All shares taken up. £5,100 considered as paid. Mortgages and charges: £2,980 (excluding interest).

Costa Rica Electric Light and Traction Co., Ltd. (56,447).—Capital, £180,000, in £1 shares. Return dated January 5th, 1914. All shares taken up, £7 paid. £129,993 considered as paid. Mortgages and charges: £286 500.

Cordoba Light, Power and Traction Co., Ltd. (99,640).—Capital, £1,000,000 in £1 shares (300,000 preference, 600,000 ordinary and 100,000 preference or ordinary). Return dated December 31st, 1913, 300,000 preference and 600,000 ordinary taken up, *£170,100 paid, £429,960 considered as paid. Mortgages and charges: £899,800.

Douglas Southern Electric Tramways, Ltd. (45,701).—Capital, £50,000 in £1 shares (30,000 preference and 20,000 ordinary). Return dated December 30th, 1913, 25,973 preference and 15,472 ordinary shares taken up, £18,370 paid on 12,466 preference and 5,804 ordinary, £28,075 considered as paid on 13,407 preference and 9,668 ordinary. Mortgages and charges: Nil.

Bullers, Ltd. (62,020).—Capital, £400,000 in 20,000 ord. and 20,000 pref. shares of £10 each. Return dated January 1st, 1914; 15,000 ord. and 15,000 pref. shares taken up; £150,070 paid on seven ord. and 15,000 pref.; £149,980 considered as paid on 14,998 ord. Mortgages and charges: Nil.

Bogota Telephone Co., Ltd. (69,059).—Capital, 45,000 in £1 shares (20,000 pref. and 25,000 deferred). Return dated January 14th, 1914; 15,200 pref. and 18,607 deferred shares taken up; £24,607 paid on 6,200 pref. and 18,607 deferred; £9,000 considered as paid on 9,000 pref. Mortgages and charges: Nil.

Collieries Electric Power Development Syndicate, Ltd. (90,729).—Capital, £10,000 in £1 shares. Return dated January 14th, 1914. 6,007 shares taken up. £1 called up on 4,000, nil on 7. £4,000 paid. £2,000 considered as paid on 2,000. Mortgages and charges: Nil.

Trowbridge Electric Supply Co., Ltd.—Particulars of £2,400 debentures, created January 26th, 1914, and secured by trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged: The company's undertaking and property, present and future, including uncalled capital and freehold hereditaments at Trowbridge. Trustees: J. H. Blake, Beechfields, Melksham, and A. H. Dougals, Brenda, Queen Drive, Colwyn Bay.

Osram Lamp Works, Ltd. (95,312).—Capital, £100,000 in £10 shares; 7,500 "A" and 2,500 "B." Return dated January 14th, 1914; all shares taken up; £10 per share called up on 5,000 "A"; £50,000 paid; £50,000 considered as paid on 2,500 "A" and 2,500 "B." Mortgages and charges: £30,000.

Phœnix Dynamo Manufacturing Co., Ltd. (77,660).—Capital, £60,000 in 50,000 shares of £1 each, and 1,000 shares of £10 each. Return dated December 11th, 1913. 28,007 £1 shares and 1,000 £10 shares taken up. £1 per share called up on 7,007, and £10 on 1,000. £17,007 paid. £21,000 considered as paid on 21,000 shares. Mortgages and charges: £20,000.

North Wales Power and Traction Co., Ltd. (78,193).—Registered July 30th, 1913. Capital, £270 000 in 44 000 ord. and 10,000 pref. shares of £5 each. Return dated January 12th, 1914. 38,700 ord. and 7,300 pref. shares taken up. £5 per share called up on 34,100 ord. £170,475 paid, leaving £25 in arrears. £66,000 considered as paid on 4,000 ord. and 9,200 pref. Mortgages and charges: Debt of £40,000 secured by issue of £80,000 first mortgage debs.; also £7,000 "B" debs. and £10,000 mortgage debs. (Total debt: £147,000. Total debs. issued: £187,000.)

* This should probably be £470,100. The return does not account for payments on 300,000 preference, but balance-sheet says issued capital £900,000.

CITY NOTES.

Bath Electric Tramways, Ltd.

The annual report states that the traffic and other receipts show an increase of £4,807 over those of the previous year. The following are the earnings for several years:—1911, £43,834; 1912, £45,998; 1913, £50,805. The mileage run by the company's vehicles has increased during the year—in the case of the tramway cars by 19,880 miles, and the omnibuses and torpedo cars by 58,898 miles. Four new torpedo cars and two omnibuses had been added The foundry belonging to the company continues to give excellent results. After charging the expenses of operation and administration for the year ended December 31st, 1913, there remains a balance of £17,003, or with the carry forward a total of £18,433, from which has to be deducted interest on 4½ per cent. first mortgage debenture stock paid and accrued to date £5,908; fifth instalment of sinking fund for first mortgage debentures, £1,000; interest on loans, £1,151; dividend on the preference shares for the year £3,750; total, £11,809, leaving £6,624. Of this there has been appropriated to contingencies and renewals account £4,000, leaving a balance of £2,624, which is to be carried forward.

It has been found impossible during the past year to issue capital for the purpose of redeeming the bank loan; nevertheless, it was absolutely necessary that the company should keep pace with the public demand put upon it in connection with the extension of its torpedo-car and omnibus business. It consequently acquired the vehicles referred to above, and must obtain still further vehicles to meet the necessities for the growing traffic. The provision of funds for this purpose, and for the repayment of of the bank loan, as well as for the cost of relaying the tramway track, which it is estimated will have to be carried out 10 years hence, has been a matter of great concern to the board. The directors therefore resolved to ask the auditors, Messrs. Franklin, Wild & Co., as officers elected by the shareholders, to furnish a report and frame a scheme to meet the position of the company as it stands to-day. The board are prepared to adopt these, and will recommend to the shareholders their adoption at the approaching annual general meeting. They feel that this will enable the company to combat any competition likely to present itself, and will at the same time greatly strengthen the position in every way. Mr. Esmond Caillard, the retiring director, does not offer himself for re-election. The board will not ask for the vacancy to be filled, and, with a view to economy, they propose a still further reduction of their number.

The scheme referred to above provides for the suspension of the preference dividend for four years, during which time out of the profits the bank loan will be paid off, and the capital expenditure for the motor fleet provided for. At the end of four years the payment of the preference dividends will be resumed, and an annual sinking fund policy premium of £4 638 paid to secure £30,000 at the end of 1923, the arrears of the preference dividends which are made cumulative being paid off. At the end of the 10 years the company would be in a much stronger financial position than it is at present, with the preference dividends all paid, the bank loans paid off, £30,000 found for track renewals, and a reserve standing at £54,000, of which £20,000 had been put into the business. The scheme, therefore, secures new capital, which is absolutely necessary, without the introduction of any addition to the actual capital of the company. It is believed that this will be regarded as a sound scheme from the point of view of the company and all classes of shareholders.

British Electric Transformer Co., Ltd.

The directors' report for the year ended December, 1913, states that they consider the result satisfactory. After paying all manufacturing costs and expenses of administration there remains a net profit of £22,007, plus £4,116 brought forward, making £26,123. It is proposed to place to reserve account £7,500, to depreciation reserve £1,500, to preference dividend of 6 per cent. for the year £3,531, to dividend of 10 per cent. on the ordinary shares (3 per cent. of which was paid as interim dividend) £8,541, carrying forward £5,052.

The articles of association of the company provide that the directors shall be paid by way of remuneration £750 per annum, and a further sum equal to 10 per cent. of the net profits of the company remaining in each year after payment of a dividend of 10 per cent. on the ordinary shares. Under this article the directors are entitled for the past year to a sum of £843, but they prefer to leave this matter in the hands of the shareholders, and to ask them to vote such remuneration (not exceeding £843) as they may think fit.

The meeting is to be held on March 5th.

Bastian Meter Co., Ltd.—Dividend on ordinary shares for 1913, 2½ per cent. per annum.

Chelsea Electricity Supply Co., Ltd.—A dividend at the rate of 6 per cent. on the ordinary shares, making 5 per cent. for the year, is announced; £2,765 is carried forward. The total dividend for 1912 was at the same rate.

County of Durham Electrical Power Distribution Co., Ltd.—The directors recommend a dividend of 5 per cent. for the year to December 31st on the preference shares, including the interim dividend already paid.

Reduction of Capital.—The British and Colonial Zoelly Turbine Syndicate, Ltd., and Reduced.—A petition for the confirmation of the reduction of capital from £20,000 to £10,000 has been presented, and will be heard on March 6th.

Continental.—Hungary.—The Ungarische Elektricitäts Gesellschaft, of Budapest, reports a net profit of only £104,948 for last year, as compared with £115,824 in 1911. The dividend is being reduced from 15½ to 15 per cent.

France.—A new company has lately been formed in Paris (5, Rue Bondreau), with a capital of £1,000,000, and the title La Compagnie Générale de Radiotelegraphie.

A new company has lately been formed at St. Dizier (Haute Marne) with a capital of £48,000, and the title La Société de l'Energie Electrique Meuse et Marne.

Spain.—The amalgamation of the Compania Co-operativa Electra and the Compania Chamberi was decided upon at meetings of the two companies on December 7th and 9th last. The terms of the amalgamation are:—The Chamberi Co. will hand over all its capital to the Co-operativa Electra, receiving in exchange 5 millions in shares of the latter. The service of the Chamberi bonds will be assumed by the Electra, with a reduction of interest from 5 to 4 per cent., but with an increased security on the assets of the two companies and the payment of the Chamberi coupons in arrears.—*Electron.*

Among the new electrical undertakings formed in Spain during the past year are the following:—La Sociedad Hidro-electrica del Genil, Seville (capital £120,000); La Sociedad Electricidad Nuestra Senora del Rosario, Madrid (£45,000); La Sociedad Fuerzas Hidraulicas del Alto Perineo, Barcelona (£40,000); La Sociedad Hidrodinamica del Ebro, Barcelona (£40,000); La Co-operativa Electrica Donostiarra, San Sebastian (£20,000); La Sociedad de Lamparas Electricas Wolfram, Barcelona (£8,400); La Sociedad Electra de Galdacana, Galdacana (£8,000); and La Sociedad del Tranvia Electrico de Ferrol a Juvia y Neda, Ferrol (£3,200).

Sweden.—The annual report of the *Allmäna Svenska Elektriska A-B.* has not yet been published, but a preliminary statement about the company's activity during the last six years is to hand; the figures in the following table need no explanation:—

Year.	Number of electrical machines delivered.	Capacity in kw.
1908	3,760	140,000
1909	3 845	105,000
1910	5 500	230,000
1911	6 011	220 000
1912	8 001	272,000
1913	10,816	340,000

Norway.—A new electro-chemical company has been formed at Fredrikstad for the purpose of erecting a manufactory for the production of soda and metallic soda and superoxides of soda. The capital of the new company is £19,500 in 700 fully-paid shares. Engineer Moltke-Hansen is appointed managing director, and the name of the new company is the "Fredrikstad Elektrokemiske Fabriker."

Germany.—A meeting of the shareholders of the Rheinische Schuckert Gesellschaft für Elektrische Industrie is about to be held in Mannheim to consider a proposal to increase the capital of the concern from £400,000 to £550,000, and to issue 5 per cent. debentures to the extent of £300,000.

Austria.—The report of the Felten & Guilleaume Gesellschaft, of Vienna, for the last financial year shows a net profit of only £73,260, as compared with £97,909 in the preceding 12 months. The dividend is being reduced from 17½ to 15 per cent.

Switzerland.—La Société Franco-Suisse pour l'Industrie Electrique, of Geneva, is declaring a dividend of 5½ per cent. for the last financial year, as compared with 5 per cent. in 1912.

Russia.—According to the *Rossija*, the Belgian companies which have working concessions in many Russian cities have amalgamated. The companies alluded to are the General Electricity Co., which controls the tramways in Odessa, Riga and Simpferopol and the telephone in Odessa; and the Tramway Co., which owns the tramways in Kiev, Saratov, Kasan, Karsk, Orel, Bjelostok, and also the lighting services in the same cities. The latter company has taken over the former, and an issue of 25,000,000 fr. new capital is to be made, with a view to purchasing new concession in Russia.

Bournemouth and Poole Electricity Supply Co., Ltd.—The directors recommend a final dividend on the ordinary shares at the rate of 9 per cent. per annum, less income-tax, for the December half-year, making 7 per cent. for the year, as compared with 6 per cent. for 1912.

Metropolitan Electric Supply Co., Ltd.—The directors recommend a dividend for the half-year to December 31st at the rate of 5 per cent. per annum, making a total of 4½ per cent. for the year. £22,000 is placed to reserve. For 1912 the dividend totalled 4 per cent.

Direct West India Cable Co., Ltd.—The directors (according to the *Financier*) have declared an interim dividend at the rate of 6 per cent. per annum (1s. 6d. per share), free of income-tax, for the half-year to December 31st.

County of London Electric Supply Co., Ltd.—The directors have declared a final dividend of 4½ per cent. per annum on the ordinary shares, making 7 per cent. for the year 1913, as compared with 6 per cent. for 1912.

Prospectus.—*City of Dunedin.*—The list of applications was to close on February 23rd in an issue of £150,000 City of Dunedin 4½ per cent. Waipori Falls Electric Power Loan at £100 per debenture.

(*Continued on page* 366.)

THE ALL-ELECTRICAL OPERATION OF THE PANAMA CANAL.

BY JOHN GEO. LEIGH.

(*Continued from page* 334.)

In preceding articles of the present series I have devoted particular attention to (1) the elaborate and far-reaching precautions to safeguard from the deteriorating influences of the Isthmian climate all electrical equipment installed for the operation of the Panama Canal; (2) the arrangement, special features and functions of the hydro-electric power station at Gatun; (3) the manner in which the energy there generated will be transmitted and distributed to the points where it is required; and (4) the systems which have been selected with a view to securing for the illumination of the locks a diffusion of light best suited to the varying conditions. Strict reference to correct sequence would demand that the next points to be touched upon should be the many unusual and distinctive features found in the switchboards for the distribution of power, and the scarcely less interesting transformer units, 36 in number, and possessing a 9 to 1 ratio, which link the power circuits from the generating station to the mains feeding the motors of the locks. Of these, however, I propose for the moment to reserve any description, giving pride of place instead to what, beyond all question, are the most distinctive and remarkable electrical features of the Canal. I refer, of course, to the centralised control, interlocking and indicating systems which will be in force at the locks in connection with the operating machinery described more or less fully in articles contributed to the Electrical Review, rather more than two years ago ("Electric Power for the Panama Canal," January 12th, 19th and 26th, and February 9th, 1912). The whole of this portion of the work was entrusted to the General Electric Co., of Schenectady, N.Y., whose valuable co-operation with the Canal Commission will be dealt with more fully in a following article.

Fig. 9.—Edward Schildhauer, Electrical Engineer, Isthmian Canal Commission, under whose supervision the specifications for the entire control system were prepared.

It is impossible to praise too highly the system—cohesive and comprehensive, yet, at the same time, comparatively simple—which has been adopted for the electrical control of the multifarious machinery installed in the locks. In passing a vessel through the locks, as has been pointed out in preceding articles, it will be necessary to open and close mitreing gates weighing from 300 to 600 tons, to fill and empty lock chambers containing from 3,500,000 to 5,000,000 cb. ft. of water, to raise and lower fender chains each weighing over 24,000 lb., and to provide electrical energy for the towing locomotives. All these operations, except those connected with the towing—which were described fully in the Electrical Review of February 9th, 1912—will be controlled remotely from a central station for each of the three series of locks: in other words, by a single man in charge of a switchboard.

Consequent upon the length of the lock flights—that at Gatun extends over 6,200 ft., the principal operating machines being distributed over a distance of about 4,000 ft.—central mechanical transmission of control would be almost impossible. On the other hand, to control the machines locally would mean a large operating force distributed practically along the full length of the locks, and such a force would be difficult to co-ordinate into an efficient operating system. The situation, therefore, has resolved itself into centralised electrical control, with the result of reducing the number of operators, operating expense and liability to accident.

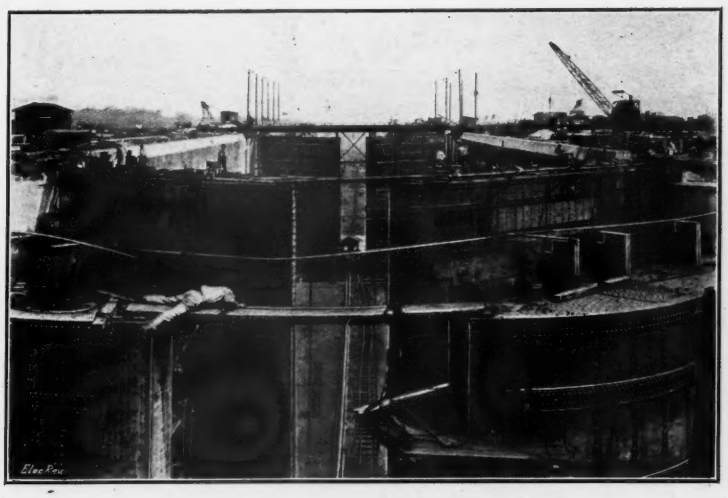


Fig. 10.—View of Three Sets of Gates at Gatun Upper Locks.

The control station is placed in a building sufficiently high above the lock wall to permit of the passage underneath

Fig. 11.—Inclined Railways for Towing Locomotives.

of the towing locomotives, and to allow an uninterrupted view of every part of the locks (fig. 12). In it is a double control board, or bench, raised 2 ft. 6 in. above the floor, duplicated to conform to the duplication of the locks, and containing a representation, part model and part diagrammatic, of the series of locks controlled by the respective series of switches. Standing at his switchboard the operator will throw the switches, and before him see, in model or diagram, the progress of the fender chains as they rise or fall, the movements of the mitring gates inch by inch, the opening and closing at every stage of the gate valves in the main culverts, the operation of the cylindrical valves, and the gradual rise or fall of the water in the lock chambers. The switches controlling the various motors, together with their indicators, are mounted upon the board in the same relative position as the machines in the lock walls. In order that the operator may be able to reach beyond the middle, the board does not exceed 4 ft. 6 in. in width, and, for reasons of like character, the length is limited to 64 ft. at Gatun, and proportionately less at the other locks, viz., 36 ft. at Pedro Miguel and 52 ft. at Miraflores (fig. 15).

The side and centre walls of the locks are represented on the board by cast-iron plates, and the water in the locks by

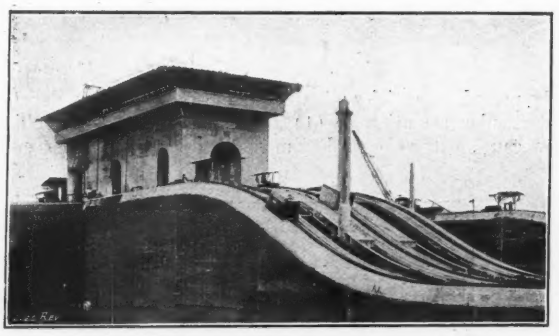


Fig. 12.—Control House on Centre Wall of Upper Locks at Gatun, showing Towing Tracks.

point in its travel. When, as in the case of the rising-gate stem valves and mitre gates, it is necessary for the attendant in the control house to follow up the progressive movements, the machines are provided with synchronous

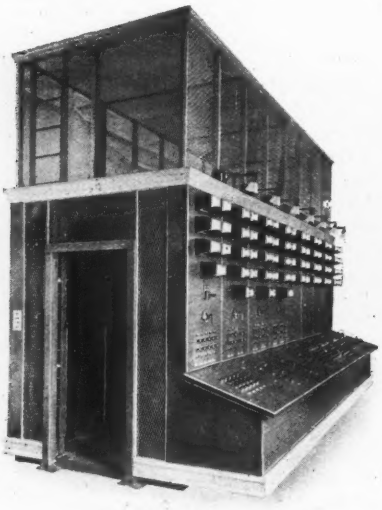


Fig. 13.—Instrument and Control Benchboard, with Gallery for Field Rheostats; Gatun Hydro-Electric Station.

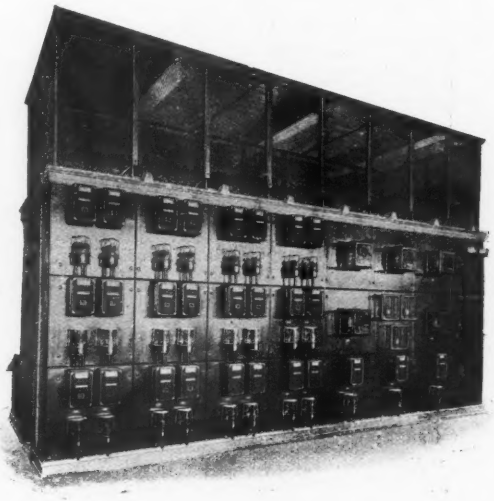


Fig. 14.—Meter and Relay Panels of Benchboard.

blue marble slabs. The receivers, transmitters and lamps are operated at 110 volts, while the control circuits are 220 volts, both using 25-cycle alternating current.

Attached to all machines are limit switches for opening the control circuit when a machine has reached the proper

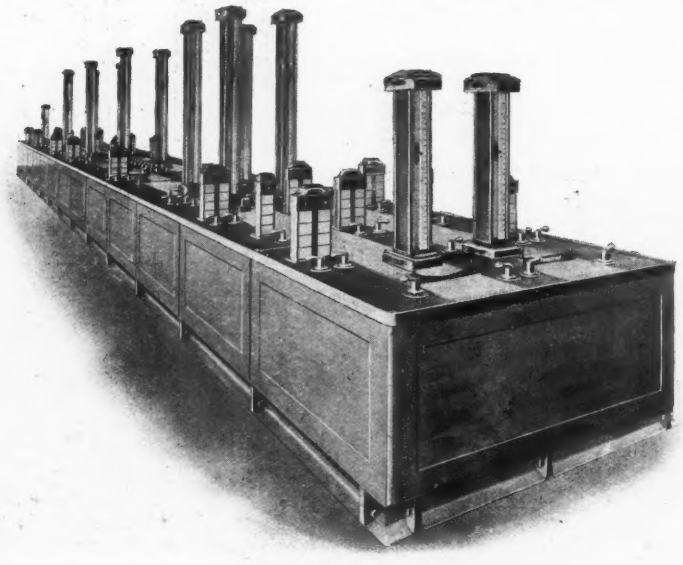


Fig. 15.—Control Board at Miraflores Locks.

indicating devices, showing, by means of instruments on the control board, the movement and position of the machines at all times. The cylindrical valve, mitre-forcing and other machines, however, only call for indication when their movement is completed, and to convey this knowledge to the operator there is attached to the limit switch an indicator switch showing, by a lighted lamp or otherwise, that the machine has reached the end of travel.

For the indications required, appliances with commutators, multiple contacts or ratchet mechanisms would not be suitable, particularly because devices of this character move step by step, and fail to indicate all points in the movement of the main machinery. The indicators on the Panama control boards, however, show accurately and synchronously every movement of the machinery to which they are connected, whether in the extremes of travel or at any intermediate point.

A complete synchronous indicator consists of a transmitter placed at, and operated by, the machine in the lock wall, and a receiver operating an indicator at the switchboard in the control house. Both transmitter and receiver have stationary and rotating parts. The stators have three-phase windings, with

leads from three corresponding equidistant points brought out and connected together, but not connected to a source of power, the stator coils being energised by induction from the rotors. The rotors are bipolar and are connected in parallel and energised from a 110-volt, 25-cycle, single-phase source.

The movement of the lock machinery, and with it the connected transmitter rotor, produces a field in the stator polarised in the direction of the rotor magnetic axis, which induces voltage in the stator coils. This voltage is transmitted by the three-phase connection above-mentioned to the receiver stator coils, and duplicates in them, but in the reverse direction, the same conditions of polarity and voltage which are present in the transmitter. The rotor of the receiver being energised by the external source in the same direction as that of the transmitter, is reacted upon by the polarised receiver stator until the magnetic axes coincide and the rotors of both transmitter and receiver are in the same relative position. Any difference in the position of the transmitter and receiver rotors causes a difference of potential between the stator windings, with a consequent flow of current and resultant torque, which again moves the receiver rotor to the same relative position as that of the transmitter rotor. The receiver rotor follows closely and smoothly the movement of the transmitter rotor, and consequently imparts to the position indicator a movement identical with the movement of the lock machine, although on a scale reduced to the requirements of the control board.

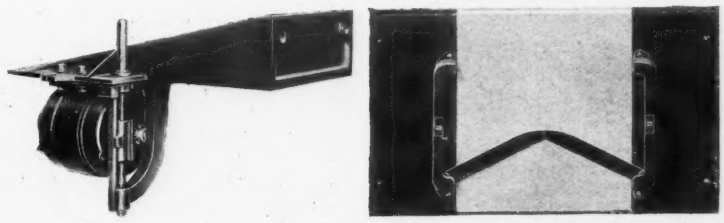


Fig. 16.—Mitre Gate Transmitter (cover removed) and Indicator.

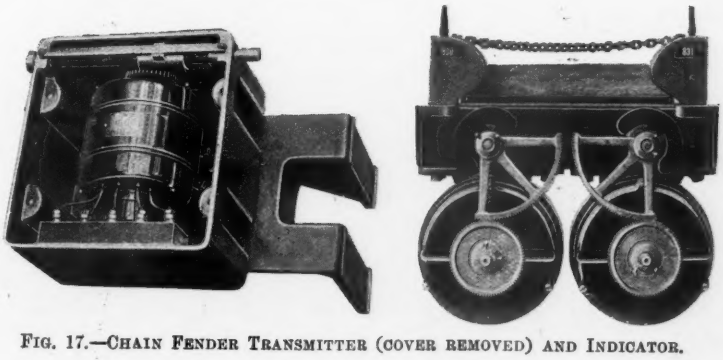


Fig. 17.—Chain Fender Transmitter (cover removed) and Indicator.

In the case of the mitreing gates, the vertical operating shaft is connected to a shaft which operates the transmitter machine. The latter shaft is threaded, and carries a nut, on which is mounted a rack. The rack engages a gear on the rotor shaft, and this turns the rotor as the gates operate. The mitreing-gate indicator comprises a pair of aluminium leaves, shaped to correspond to the plan view of the top of the gates, which travel horizontally just above the top of the board, the hinge ends being connected to shafts extending down through the surface of the board, where they are geared to the receivers by means of bevel gears. When the miniature gates are completely opened, they are covered by shields to give the effect of the gates folding back into recesses in the lock walls.

For the chain fender, the position indicator transmitter is driven by the shaft operating the limit switch, which controls the stroke of the piston. The indication on the board is given by a small aluminium chain, which, like the large chain, is raised and lowered, each end operating independently, the large chain being lowered to the bottom of the lock and the small chain into a slot on the control board. The ends of the miniature chain are fastened to semaphore arms, which are connected to segmental gears meshing with the driving gears on the receiver machines. As the receiver rotors turn, the chain is either lifted or lowered, the position of the large chain above the bottom of the lock being indicated by the angle of the semaphore arms.

As the rising-stem valves occur in pairs, their position indicator machines occur in pairs also. The transmitter rotor is driven by a shaft and gearing similar to that described for the mitreing gates. Each indicator is similar to a small elevator, a car being used to indicate the position of the valve gate. Both front and back of the shaft are fitted with opal glass marked with black lines for the $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ positions. A small aluminium cage moves up and down in each compartment. A drum for operating the cord which raises and lowers the cage is placed underneath the control board, and is operated by the receiver through a suitable train of gears. To make the indications visible from points up and down the control board, the elevator shaft under each car is always illuminated, while the portion above is dark.

The specifications covering the water-level indication required an accuracy of $\frac{1}{30}$ ft., or $\frac{1}{10}$ of 1 per cent. in actual water level. In the transmitters and receivers for the machines already described, the rotors turn less than 180°, with an inherent lag in this distance of $1\frac{1}{2}$ per cent. between transmitter and receiver rotors. This obviously prevents such an arrangement from being employed to give the water-level indication. It was found that if the rotors were revolved 10 complete revolutions, the required accuracy could be obtained; but since this arrangement makes it possible for the rotors to be in synchronism every 180°, or

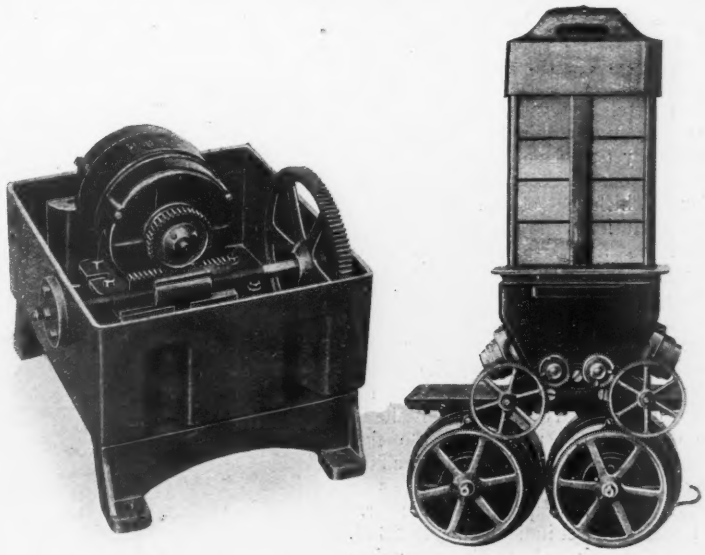


Fig. 18.—Rising-Stem Valve Transmitter (cover removed) and Indicator.

in 20 different positions for the entire travel, the indicators would not indicate correctly if, for some reason, the trans-

Fig. 19.—Interlocking Racks below Control Board.

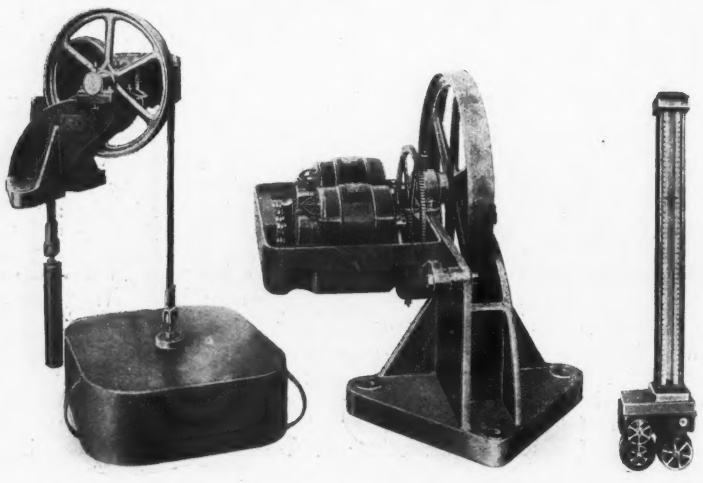


Fig. 20.—Water-Level Transmitter with Float; Ditto, with Cover Removed, and Indicator.

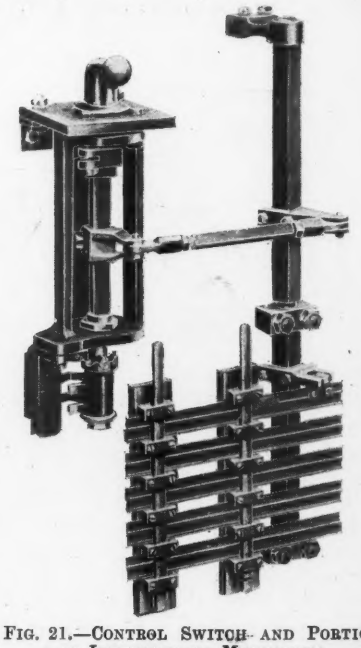


Fig. 21.—Control Switch and Portion of Interlocking Mechanism.

mitter rotors were turned more than half a revolution with the power off. Therefore, the required accuracy was obtained by two sets of transmitters and receivers, one set connected to a fine index in which the rotors make 10 complete revolutions, and the other set connected to a coarse index operating through less than 180°.

The fine index is a hollow cylinder carrying a pointer, the length of the cylinder being such that when an aluminium ball representing the coarse index, which can be depended upon for coarse indication, is within the limits of the cylinder, the reading of the fine index is correct within the limits specified. The scales are illuminated by lamps in both base and top caps of the indicator.

For water-level indication, wells 36 in. sq. in the lock walls, with communication to the lock by a small opening at the bottom of the well to dampen surges, contain a welded steel box float, 30 in. sq. × 9 in. deep. A non-slipping phosphor-bronze belt transmits the movement of the float to a sheave fitted with pins on the transmitter mechanism, the pins registering with holes punched in the belt. The sheave shaft is carried in ball bearings with oil cups for lubrication and drainage cocks at the bottom of the bearings.

The position of the mitre forcing machine is not indicated by synchronous indicators, but its open and closed positions are shown by red and green lights, and a mechanical indicator on the control board representing the machine.

The control system at all the lock flights is identical. Water is let into or withdrawn from the lock chambers by means of culverts under the lock floors, connecting with larger culverts in the lock walls, through which water is carried from the higher to the lower levels. The main supply culverts are 18 ft. in diameter, and the flow of water through them is controlled by means of rising-stem gate valves, which can be completely opened or closed in a minute. The culvert in the centre wall feeds both lock chambers, and, consequently, at each outlet to the lateral culverts there is a valve of the cylindrical type, by which either chamber at will may be filled or emptied. A complete opening or closing of these valves can be effected in 10 seconds. It should be noted that the mitreing gates are never opened or closed with a head of water on either side, the chambers being first emptied or filled by means of the culvert system.

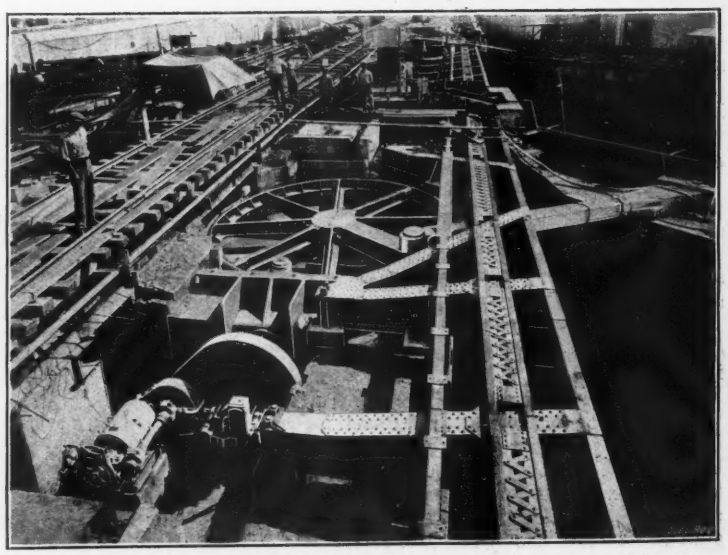


Fig. 22.—Mitre-Gate Moving Machine, Gatun Upper Locks.

When, from the northern end of Gatun Locks, a ship requires to be raised to the Lake level, she comes to a full stop in the forebay of the lower lock, preparatory to being taken charge of and towed by electric locomotives through one of the series of duplicate lock chambers. The water in the first chamber having been equalised with the sea-level channel, the gates will be opened, the fender chain lowered and the vessel permitted to enter. Then the gates will be closed and mitred; the rising-stem gate valves above will be opened so as to fill the chamber below, and the vessel will be raised 28 ft. 4 in. to the second level. These operations will be repeated in the middle and upper locks until the ship has reached the summit level of the Canal, 85 ft. above the ocean surface.

At Gatun, when passing a large vessel through the locks, it will be necessary to lower four fender chains, operate six pairs of gates and force them to mitre, and open and close eight pairs of rising-stem and 30 cylindrical valves. Altogether, not fewer than 98 motors will be set in action twice during each lockage of a ship, and this number may be increased to 143, according to the previous condition of the gates, valves and other devices. Each gate leaf, valve and fender chain is operated by an individual motor mounted near the machinery in the lock wall, the motors acting through suitable gears—or a pump, in the case of the fender chains—upon the various machines. In each machinery room is a starting panel, containing contactors, by which current is supplied to the motor, and these panels in turn are controlled from a main unit in the central control house. Ninety per cent. of the machinery rooms at Gatun Locks are within 2,000 ft. of the point of control, 50 per cent. of the total are within 1,200 ft., but others are distant 2,700 ft.

All contactors are operated directly from the central control house without the intervention of relays, and without resistance in the control circuit. Small and medium-sized motors are started and reversed by throwing directly on the line, which will be normally at 220 volts and 25 cycles; but motors above 25 H.P. have, in addition, one starting point in each direction with resistance in the primary. All motors are of the squirrel-cage type, except those for the locomotive traction, which are of the slip-ring type. Starting resistance has been preferred to compensators, in order to secure the simplest possible arrangement with a minimum number of contactors, and to obtain an unlimited range of adjustment in the starting resistance. Reversing is done by double-pole contactors, mechanically interlocked, and, in order to have all contactors on a panel alike, when a starting resistance is used, the resistance will be in two legs only of the three-phase circuit, and short-circuited by means of a double-pole contactor. The contactors are designed for normal operation at 220 volts and 25 cycles, but will continue to operate successfully if the voltage at the contactor coil terminals falls as low as 70 per cent. of the normal.

Motors for the rising-stem gate valve machines have a rating of about 50 H.P.; the mitre-gate moving and guard valve motors of 35 H.P.; the fender chain pump motors of about 25 H.P., and the cylindrical valve and other motors 7½ H.P. The aggregate number of motors at all the locks, including 207 required to drive various pumps and pumping machinery, is 951. The following table shows the sizes and number of those employed in driving machinery:—

Machine and operation.	H.P.	Number of motors.			Total H.P.
		Gatun.	Pedro Miguel.	Miraflores.	
Mitre gate, moving, each leaf	25	40	24	28	2,300
Mitre gate, mitre forcing	7	20	12	14	322
Fender chain, main pump	70	16	16	16	3,360
Fender chain, operating valve	½	16	16	16	24
Rising-stem gate valve ...	40	56	24	36	4,640
Cylindrical valve	7	60	20	40	840
Guard valve	25	6	6	6	450
Auxiliary culvert-valve ...	7	4	4	4	84
		218	122	160	12,020

Interlocking is an essential feature of the control system, with consequences that certain motors cannot be started in a certain direction until other motors are operated in a proper manner to ensure consistent operation on the whole, and undesirable combinations will be avoided in the positions of gates, valves or fender chains. By the use, also, of limit switches, the factor of personal equation will be reduced to a minimum. For example, before the operating pair of valves in the main culverts can be opened, at least one pair of valves at the up-stream and down-stream ends of the lock must be closed. This limits an operator at this stage to the act of equalising water levels between lock chambers, and restricts him from allowing water to flow from, say, the Lake level to the middle lock past the upper lock, thus preventing a possible flooding of the walls and machinery rooms.

Interlocks devoted to the control of action between the gate valves in the main culverts and the mitreing gates prevent the opening of valves a lock length above or below a gate which is being opened or closed, and thus render it practically impossible for an operator to cause a flow of water while the gate is being moved. Again, interlocks for the cylindrical valves guarding the openings from the centre wall culvert to the lateral culverts will keep those of one side or the other closed at all times, except when it may be desired to cross-fill the chambers, when they may be opened by special procedure. Other interlocks prevent the operator from starting to open a mitre gate before unlocking the mitre-forcing machine, and ensure that the switches must be thrown in such order that a mitre gate guarded by a fender chain must be opened before the chain can be lowered, and that the chain must be raised again before the gate can be closed.

The interlocks are contained in two vertical racks under each edge of the control board, and some distance below (fig. 19); the space under the board is left open, so that all parts on the underside of the board are accessible from the floor below. The interlocking system is essentially a bell-crank mechanism (see fig. 21), connecting the shaft of the control switch through a movable horizontal bar to a vertical operating shaft, which may or cannot move, according to the relative positions of the interlocking bars and dogs. Every control switch uses a horizontal bar from 3 ft. to 50 ft. long.

The interlock system depends mainly on the action of engaging bevel dogs placed on the horizontal and vertical bars, the movement of a horizontal bar tending to lift a vertical bar by bevels on the dogs. A horizontal bar cannot be moved without raising a vertical bar. Consequently, if, at any time, a dog on a horizontal bar rests against the upper end of a dog on a vertical bar, no movement of the horizontal bar where the dog engages with the vertical bar can take place, and the control handle connected to that particular horizontal bar is locked.

As has been stated, interlocks prevent a chain fender being lowered until adjacent mitreing gates have been opened, and also prevent the gates being opened until the chain is in the raised position. Thus it is assured that the chain fender will always be in the "up" position to protect the gate when the gate is closed. To avoid unnecessary complication, each end of the chain is interlocked only with the leaf on its side of the lock, because, as a rule, both leaves of a gate, as well as both ends of a fender chain, will be opened simultaneously, and further inter-locking is unnecessary. After the mitreing gates are closed, a mitre-forcing machine is operated by a control handle and locks the ends of the gates closed. This machine cannot be operated until the gates are closed.

The rising-stem valves of the side wall, next above or below a mitre gate, must be closed while the mitre-forcing machine is open. As the latter machine cannot be closed until the gates are closed, this means that the valves either above or below the gate must remain closed until the gate itself is closed, thus preventing the operator from creating a current of water around the gates while they are open, or are being moved in opening or closing. This interlock is not included on the middle wall valves, because these will be used with the locks on either side, and consequently must be free.

Either pair of rising-stem valves may be opened first, at the choice of the operator, an interlock becoming effective when the first valve of the second pair of duplicates is opened. This is effected by a novel arrangement of

equalising levers acting against the ends of the interlock bars, with a certain definite amount of lost motion which is taken up on opening the first pair of valves, thus putting the interlocks in operation on the next pair.

In most cases the locks are divided into two unequal parts by the intermediate mitreing gates. This arrangement makes it necessary to divide the 10 cylindrical valves into two groups of, respectively, seven and three, for the long and short lengths. A selecting lever is provided for these interlocks, and may be set as indicated by a nameplate on the lever to "three," "seven," or "ten" respectively, whereupon the corresponding valves are subject to that interlock, and the others of the group of 10 are locked closed if three or seven only are to be used. A failure on the part of the operator to make his selection properly in advance will simply cause him the trouble of going back and doing so, as the remaining valves are locked closed. This arrangement permits the handling of small vessels without causing waste of water due to operating such vessels in the large chambers.

When a large vessel is to be locked through, the interlocks on the intermediate gates can be made ineffective by the operation of a Yale lock, which uncouples a clutch and disconnects the central switch from the operating mechanism. A turn of the key removes the interlock and permits the intermediate gates to be thrown open to obtain a 1,000-ft. chamber, and the valves are operated independently of these gates.

A commutating switch used in connection with the mitre-gate moving machinery serves two purposes. First, when the gate leaves come to the closed position, and not until then, the switch completes a circuit from the control house, by means of which the machine for forcing and holding the gate in proper position may be closed. Thus there is given an interlock, by virtue of which the operator cannot close too soon the mitre-forcing machine. The other function is to alter the circuits controlling the rising and falling of the handrail of the footbridge over the gate, so that should the rails be up when the gates commence to open, they will be automatically lowered. Were the rails allowed to be up when the leaves were opened back into the recesses of the lock walls, they would interfere with a passing towing locomotive. Consequently the circuits for raising the rails are disconnected so that they cannot be raised as long as the gates are open.

As illustrated in fig. 22, and described in the ELECTRICAL REVIEW of January 26th, 1912, the lock gates are opened and closed by means of a strut or connecting rod acting between the gate and a crank pin on a large driving gear. The relation of the parts is such that a toggle effect is produced near the ends of travel, and the motor would be capable of causing damage to some of the parts in the event of the gate leaf meeting with an obstruction. One end of the strut, therefore, is allowed a telescopic movement of a few inches against a nest of springs, which latter hold the telescopic parts against stops with sufficient initial tension to ensure that, with ordinary water resistance to the gate in normal operation, there will be no change in the length of the strut. Should the gate, however, meet a solid obstruction near one end of its travel, when the motor is capable of producing overload on the mechanical parts, the strut is compressed or extended, according to the direction of the forces. The cut-out switch is mounted upon one end of the telescopic device, while a rod entering the switch casing is attached to the other. The movement of this rod in and out of the casing operates the switch to open the control circuit and stop the motor, and is so arranged that if the switch is operated by compression of the strut that side of the control circuit is opened which produces a rotation of the motor corresponding to compression, the other circuit remaining unbroken for reversing and drawing the gate from the obstruction. If operated by tension and the motor is stopped, it is possible to reverse and apply compression to the strut.

(To be continued.)

Whist Drive.—The members of the Portsmouth Royal Dockyard Electrical Engineer Ex-Apprentices' Association recently held their fifth whist drive and dance at Madden's Hotel, Portsmouth; 200 members and friends were present.

CITY NOTES.

(Continued from page 360.)

City of Buenos Ayres Tramways Co. (1904), Ltd.

MR. JOHN HEATON presided on February 16th at Winchester House, E.C., over the annual meeting of this company.

In moving the adoption of the report (see ELEC. REV., page 284), the CHAIRMAN said it would be satisfactory to all, and the only remark he had to make was as to the further improvement in their position. The annuity from the Anglo-Argentine Co. had been received and distributed to the debenture and shareholders, and from every point of view it was satisfactory to know that the revenue of the Anglo-Argentine Co. still continued to increase. Their share in the prosperity of the Anglo-Argentine Co. was, of course, a very small one comparatively, but it was all-important to them. They received from the Anglo-Argentine Co. £70,660 a year, which was a first charge upon the revenue of that company, which now amounted to considerably over £1,000,000 a year. Their amortisation funds had been more than fully maintained, and the basis on which they originally established them had been proved to be very satisfactory. It was first by the investment of certain sums for the debenture-holders, and then for the general amortisation fund. They applied the rents of various farm and other properties they had, to the funds, and whereas in 1911 they placed £3,650 to the funds, last year they placed £4,500, and this year they were applying the sum of £5,000. With reference to this fund, it would be satisfactory to shareholders if he just read a passage from the auditors' certificate. Messrs. Cash, Stone & Co. said: "In our opinion the position of both the funds is quite satisfactory, and the purpose for which they were instituted has, up to the present, been more than fulfilled." He thought that must be satisfactory to them all. The only item in the accounts to which he need refer, was £144 for the registration of their debenture stock trust deed under the new Argentina Debenture Law. That, of course, was an item which would not recur.

MR. E. H. WOODS seconded the motion, and after MR. CUFFE had expressed his satisfaction, the report was adopted.

New Companies in 1913.—The *Investors' Guardian* has published its annual analysis of company registrations. The statistics of new registrations are stated to faithfully reflect the cramping influence of a money market stringency. There was an increase of 1 per cent. in the number of registrations, but the total capitalisation at £146,766,000 is 11 per cent. less. We select the following figures relating to certain sections:—

English registrations.	1911.	1912.	1913.
Number of companies	5,959	6,796	6,871
Coal and fuel	£4,305,680	£4,973,845	£6,644,383
Electric	3,166,645	7,579,780	6,102,389
Engineering and hardware ..	8,424,462	8,885,757	10,774,891
Gas	838,125	407,900	281,710
Motor, cycle and carriage.. ..	2,721,345	7,253,879	8,934,265
Oil	15,860,820	23,533,182	12,978,939
Plantation and rubber	9,458,775	3,219,965	4,338,500
Railways and tramways	5,186,855	3,164,200	2,764,007

Scarborough Electric Supply Co., Ltd.—The report for the year ended December 31st states that there has been connected to the mains the equivalent of 4,546 (30-watt) lamps, making a total to date of 122,875. The units supplied, including the 300,000 minimum supply to the tramways, were 997,503. After placing £1,000 to depreciation account there is a balance on revenue account of £3,847. The directors recommend a dividend at the rate of 3 per cent. for the year, absorbing £3,000, leaving £847 to be carried forward. Mr. J. B. Simpson has retired from the board after 20 years' service.

Wemyss and District Tramway Co.—The directors report that the traffic receipts for the year are £15,845, and the profits £4,351. It is proposed to write off £500 for the betterment of the undertaking, to add £1,306 to the depreciation reserve fund, to pay £1,255 in dividends of 7½ per cent. on the ordinary and preference shares, and to carry forward £1,072. This is the first time the cumulative preference shares have exceeded the guaranteed 6 per cent. The line is being doubled from Leven to Buckhaven, the first stage in the provision made to accelerate the service to Kirkcaldy.

Aberdeen Suburban Tramways Co.—The profit earned for the half-year ended January 31st, amounted to £1,484, making, with the sum carried forward from the previous half-year's accounts, a balance of £2,453. The directors recommend that the sum at the credit of profit and loss account should be carried forward as usual at this time. A new agreement has been concluded with the Corporation of Aberdeen for the supply of electric energy to the company at a price of 1⅜d. per unit, being a reduction of ⅜d. per unit from the price at present payable.

Vulcan Boiler and General Insurance Co., Ltd.—The directors report £62,160 at credit of revenue account, including £9,035 brought forward. After placing to current risk and reserve fund £7,500, £1,200 to superannuation and benefit fund, a final dividend of 6s., together with 2s. bonus, per 50s. paid share is recommended, making 25 per cent. for the year, carrying forward £9,320.

Ascot District Gas and Electricity Co.—The directors' report for the year ended December, 1913, shows a profit on gas account of £5,320 and £1,592 on the electricity account.

Consolidated Diesel Engine Manufacturers, Ltd.

MR. J. M. FELLS presided on Friday at Salisbury House over a largely attended extraordinary meeting of Consolidated Diesel Engine Manufacturers, Ltd., to consider resolutions put forward by the majority of the shareholders' committee and amendments by Mr. E. A. Richardson, who was also a member of the shareholders' committee.

The resolution before the meeting was to the effect that the report of the majority of the shareholders committee (the principal points of which were given in last week's ELEC. REV.) should be approved, that the provisional agreement dated February 28th, 1914, made between Messrs. Alphonse, Georges, Gaston and Charles Carels, and Usines Carels Frerés, Ltd., on the one part, and Mr. J. C. Inglis on behalf of the shareholders' committee on the other part, be ratified; that the company be voluntarily wound up and re-constructed, and the new company be registered as the British Diesel Oil Engines, Ltd., or some other similar title.

The CHAIRMAN expressed the hope that shareholders would do nothing to unduly depreciate the property of the company, but would bear in mind the permanent interests of the company. He proposed that the meeting should first vote on the resolution of ratifying the agreement with Messrs. Carels, as this was proposed not only by the majority of the committee but also by Mr. Richardson, who would move an amendment.

Mr. J. H. DAVIDSON, in moving the resolution of the majority of the shareholders' committee, pointed out that unless a majority of three-fourths of the shareholders was obtained they could neither reconstruct nor go into voluntary liquidation. It would mean a deadlock and compulsory winding-up, which would be ruinous to the company. He ought to mention that Mr. Gregson had cabled withdrawing his name from the report. The committee had considered the legal liability of the promoters and directors, and saw no reason to doubt the honesty and integrity of the directors. Hence they had decided to abandon all legal proceedings against the directors.

At this stage, at the request of shareholders, the full agreement proposed with Messrs. Carels was read.

Mr. Davidson, continuing, explained the reason why the committee recommended the abandonment of their half-share in the works of Messrs. Carels. He said that from a report by Messrs. Deloitte, Griffiths and Co., the liabilities of Messrs. Carels, apart from trade creditors, was on January 14th, 1914, £215,000; and if their company held half of these shares, they would be liable for half of this amount. The majority of the committee suggested reconstruction on the basis of the English works only, and that would mean an assessment on the shares. On the other hand Mr. Richardson simply suggested that they had had enough of such a miserable company, and that they should wind up and cut their inevitable loss. Mr. Fells again wanted to reconstruct on the basis of retaining the half interest in Carels. It was for the shareholders to choose which course they though fit.

Mr. PEDDIE seconded the resolution, and charged the directors with considerable neglect of the interests of the shareholders in their dealings with Carels. Incidentally he mentioned that the high-speed engine had to be abandoned and the other types of engines supplied by Carels during 1913 had been satisfactory, and a profit had been made but not a large one. The committee had inspected the Ipswich works, and could not complain as to the capital expenditure there.

Mr. E. A. RICHARDSON then moved as an amendment that the provisional agreement with Messrs. Carels be ratified, and that the company be wound up voluntarily. He said he had repeatedly asked for a certified statement of their financial position to date, but it had not been forthcoming. It was unthinkable that any commercial or technical men would undertake the position of directors until they knew everything was satisfied. The orders they had got had not proved satisfactory, for they were orders taken at any price. To subscribe to a reconstruction scheme simply meant prolonging the agony.

Mr. GOVER seconded the amendment.

Mr. LAWSON (a member of the committee) said up to a point he sympathised with Mr. Richardson, but he felt after a visit to the Ipswich works that they had a property worth saving. He also had the assurance that suitable men could be found to carry out a scheme. Before voting he thought they ought to know what scheme the board intended to produce at the adjourned meeting.

The CHAIRMAN said that Mr. Gregson, who had 12,000 shares and had signed the report of the shareholders' committee, had withdrawn his name from the circular. The main difference between him and his colleagues was the question of the retention of their interest in Carels Frères. He considered that the committee had gone astray in endeavouring to do something without taking technical advice either as regards engineering or financial questions. The committee had referred to the obligations of the Carels business, but, as a matter of fact, the amount owing to the firm was in excess of their obligations. As the holder of £100,000 shares in the company, the Carels Co. could have used their vote in favour of the tempting offer made by the committee, but with the high sense of honour which the firm had they would not do so. Although the capital, etc., required adjustment, yet he had no reason to modify his previous view, that, given that the company was wisely directed and well managed, it had great potentialities. In conclusion he characterised the proceedings of the shareholders' committee as being those of "Alice in Wonderland."

Answering Mr. Spenser, the CHAIRMAN said the company had no monopoly in the manufacture of Diesel engines.

Mr. BRENDON, representing Messrs. Carels Frères, said that he was informed by his clients that the obligations of Carels Frères were in no sense debentures or mortgages. They were simply loans, and would rank with the claims of other companies. The scheme in the agreement would in no way care for his clients.

A show of hands was then taken on the question of the agreement with Messrs. Carels Frères, and this was lost by a large majority.

The amendment of Mr. Richardson to wind up the company voluntarily was then put, and carried, and stood as the substantive motion.

The CHAIRMAN then moved an amendment that the meeting be adjourned till March 10th, and that in the meantime the directors, with an advisory committee, consider a scheme for the carrying on the company which might be considered with Mr. Richardson's proposition.

The Chairman's amendment was carried on a show of hands.

It was stated that the Chairman had proxies for 110,000 votes.

Waste Heat and Gas Electrical Generating Stations, Ltd.

THE directors report that the profits earned during the year ended 31st January, 1914, after deducting administration expenses, amounted to £38,245 (for 1912 £36,010), less transferred to the credit of reserve account £9,500 (£9,500), plus the balance brought forward £8,965 (£7,555), and the profits available were £37,710 (£34,565). The directors propose a dividend at the rate of 8 per cent. for the year, absorbing £25,600 (£25,600); of this an interim dividend of 2½ per cent was paid in August, 1913. There is a balance to be carried forward of £12,110, as compared with £8,965. Including the amount transferred from the profits of this year, the total amount standing to the credit of the reserve account is now £42,851, and the redemption funds in respect of plant supplied on hire-purchase terms amount to £5,679. The company acquired during the latter part of the past year two new generating stations at Horden and Shotton, in the County of Durham, where exhaust steam from the works of the Horden Collieries Limited is utilised. Each of these stations has a capacity of 1,350 H.P. and satisfactory agreements have been made for their operation and maintenance. The shares which the company holds in the Bankfoot Power Co., Ltd., are now fully paid and have yielded a satisfactory return. The company has taken up £45,100 second debentures of Cleveland and Durham Electric Power, Ltd., which have been issued recently under the re-arrangement of that company's debenture stocks. These debentures carry interest at the rate of 6 per cent., and are re-payable by means of a sinking fund in 25 to 30 years. The whole of the company's generating stations and plant have been maintained in thoroughly efficient repair during the year. Certain proposals under which the company will erect further generating stations for the utilisation of waste heat or gas are still under consideration, and it is hoped that the negotiations will be concluded during the course of the present year.

The meeting is to be held to-day at Newcastle-on-Tyne.

City and South London Railway Co.

THE annual meeting was held on February 18th at the Westminster Palace Hotel, the Right Hon. C. B. Stuart Wortley, K.C., M.P., presiding.

In proposing the adoption of the report (see ELEC. REV. p. 280), the CHAIRMAN said there had been a heavy drop in receipts, coupled with a serious rise in expenses. These were showings which all would hope were due to temporary causes, and would disappear with the removal of those causes. There had been an enormous development in surface competition. Both in quantity and quality the rival means of transport had been improved in ways which their present resources did not enable them to adopt. Those adverse influences were already in operation a year ago. Their view of their importance and their menacing nature prompted the advice which they gave to the ordinary shareholders to exchange their shares for London Electric, and to their preference stockholders to join with their new partner (the Underground Electric Railways Co. of London, Ltd.) in seeking power to modernise and re-equip the whole installation of the City and South London Railway. The only matter in which their foresight fell short of reality was that they under-estimated the rapidity of the development of the new forces arrayed against them. They claimed, however, that that unexpectedly more rapid development of that competition, to the extent by which it exceeded their forecast, only added to the justification of the policy that they advised. That policy was that they should apply to Parliament for powers to effect a physical junction at

Camden Town with the Hampstead Tube of the London Electric Railway from Euston, and to make such enlargements of their own tunnels and renovations or replacements of the rolling stock as would be suitable for an up-to-date modernised tube railway service right through from Clapham Common, through the Bank, King's Cross, and Euston, to Hampstead, and eventually to Edgware. They made in due course their application to Parliament and obtained these powers. Their bill received the Royal Assent in August last, and it was under the special powers therein conferred that they were proposing to charge to capital the shortage in the interest of their 1903 preference stock for the latter half of the year under review. The engineers were actively at work on the preparation of the working plans for the reconstruction of the tunnels, and, with the improving conditions of the money market it was hoped that in the near future arrangements could be consummated for financing the contemplated alterations and improvements. He might say that they had not left untried such means as their existing resources permitted of bringing back or retaining the traffic that was leaving them. They had run more train miles by 2.71 per cent., and more car miles by the lesser percentage of 6.36 per cent. These figures showed that they had sought to make their service more attractive by running more frequent trains. But they showed also that this had not been extravagantly done, because the increase in car mileage measured against the increase in train mileage, suggested care taken in seeing to it that where possible some of the added trains should draw no more cars than the public wanted. Another evidence of the same economy was the fact that their total costs per train mile were less than in 1912, being 14.396d. against 14.632d. Unfortunately this improved service did not get from the public the full response desired, for the number of passengers was down by 7.36 per cent., and the total passenger receipts were down by 9.25 per cent. Likewise the passenger receipts per train mile were down by 4.54 per cent.., and the total receipts per passenger were down by 0.32 per cent., while the cost per passenger was up by 0.129d. (about one-eighth of a penny). This explained the heavy decrease in net receipts; but on the receipts side he might add that the financial result of the decrease in the number of passengers were made worse by the fact that in consequence of a lowering of fares on the L.C.C. tramways in their district, they considered it advisable to make certain reductions in their own fares. These took effect on November 1st last. The increase in expenses was contributed to by improved conditions of service granted to certain of the staff, and to the higher price paid for coal, during the year under review; their increased train mileage also caused them to consume a larger tonnage than in 1912. In conclusion he reminded them that they were now in a period of transition, and transitions and changes generally brought about discomfort and anxiety. They must hope that in their case they were now in the most uncomfortable and anxious stage of their change, and that before very long the changes in their condition would be for the better.

Mr. C. T. JENKIN seconded the motion, and the report was adopted.

Newcastle and District Electric Lighting Co., Ltd.

THE directors' report for the year ending 31st December, 1913, shows that the units sold were 16,863,440 as against 14,789,149 sold in 1912, an increase of 14 per cent. The gross profit was £30,824, plus £8,695 brought forward, making £39,519, less interest on 4½ per cent. first mortgage debenture stock, 6 per cent. second mortgage debentures, temporary loans, &c., £15,829, and deducting interim dividend paid 16th August, 1913, £4,201, leaving an available balance of £19,489. It is proposed to pay a dividend at the rate of 5 per cent. per annum (less income tax) for the December half-year (making with the interim dividend 4 per cent. for the year) absorbing £7,002, to transfer to second mortgage debenture redemption fund £2,001, to write off second debenture issue expenses £400; and to carry forward to 1914 £10,076. The directors have redeemed during the year a further £2,200 of the company's 6 per cent. second mortgage debentures. As in previous years the whole of the property owned by the company, including plant, machinery, mains, etc., has been maintained in a high state of efficiency out of revenue. At the meeting to-day, Friday, the shareholders will be asked to sanction an extension of borrowing powers by £50,000 beyond the limit fixed by the articles.

Para Electric Railways and Lighting Co, Ltd.

THE directors report that the revenue for the year ended 30th November, 1913, after providing for all expenses in London and Para, is £128,857, plus £9,870 brought forward, and difference in exchange, interest and transfer fees, etc. £2,178, making a total of £140,906. Deducting therefrom interest and sinking fund on debenture stock £38,500, and interim dividends paid for the half-year to 31st May, 1913:—On preference shares, 3 per cent. for half-year, £9,600, on ordinary shares, 5 per cent. for half-year, £19,500, there remains a balance of £73,306. Out of this it is proposed to place to depreciation and renewals reserve £15,000, and to contingencies reserve £10,000, to pay a final dividend of 3 per cent., less income tax, on the 6 per cent. cumulative preference shares for the half-year to 30th November, 1913 (making six per cent. for the year) £9,600, and a final dividend of 5 per cent. less income tax on the ordinary shares for the half-year to 30th November, 1913 (making 10 per cent. for the year) £19,500, leaving a balance to be carried forward of £19,206. A new boiler has been installed in the power house and 11.5 kilometres of new underground cables have been laid, replacing an old boiler and old underground cables of the value of £6,204, which amount has been charged against the renewals reserve and credited to construction capital account. The capital expenditure of £8,722 represents the addition of eight new cars and other minor additions to equipment. The physical condition of the plant, and operating conditions generally, have further improved. The directors report the death on 31st October, 1913, of their chairman, Sir Williams Evans-Gordon. Mr. Follett Holt was elected a director on 7th January, 1914, and subsequently elected chairman.

The annual meeting is being held to-day.

Liverpool Overhead Railway Co.

THE annual meeting was held on February 17th, at Liverpool, Mr. H. C. Woodward presiding.

The CHAIRMAN, in moving the adoption of the report (see ELEC. REV., p. 283) said that it showed the best results obtained since the year 1900, when the severe electric tramway competition was started. They had carried during the past year on railway and tramway a million passengers more than in the previous year, and the greatest number since the railway was opened for traffic, now just twenty-one years ago. This increase was general in all classes, and had yielded an increased revenue of £6,840, at an extra expenditure of £1,694. They had placed £4,000 to renewal fund, which now stood at £49,842, they had added £400 to contingent fund, and the usual premium to the insurance fund, which stood respectively at £2,100 and £1,646. A further £340 had been applied to extinguishing the cost of the new debenture issue. With reference to the amount placed to the credit of the renewal fund, he stated that for a few years after the opening of their tramways between Seaforth and Crosby they allocated £4,000 a year to that fund, but owing to increased competition and falling receipts this was reduced to £3,000 after 1905. They had now been able to reinstate this figure, deeming it wise in good years to strengthen their financial position, so as to provide for any necessary expenditure due to an expanding business. The expenditure for the year on the railway amounted to £44,501, and on the tramways to £10,975, making a total of £55,476, an increase of £1,694, accounted for principally by increase in wages, extra cost of coal, and National Insurance premiums. The maintenance of the structure and the rolling stock and electric equipment had received careful attention, and the whole were in excellent condition, being periodically overhauled. Their traffic was keeping up well. The opening of the Gladstone dock had resulted in the transfer to it of several of the Cunard liners from the Huskisson and Canada docks, and this was no doubt bringing them increased revenue. Their recent issue of debenture stock amounted to £165,580. This was £40,920 less than they had previously to pay interest upon, and was £60,920 short of the total amount that they proposed to issue in replacement of the terminable debentures, which expired on January 1st, 1913. Although their accounts showed a considerable saving of interest due to this circumstance, yet with the view of correctly adjusting their capital account, the directors would be pleased to allot the whole or any portion of this unplaced balance, and if there were at the meeting any capitalists suffering from the present three per cent. bank rate, and the consequent reduction of interest on their bank deposits, they would be well advised to consider whether a home railway debenture of this quality, paying four per cent., and with its interest guaranteed by the Mersey Dock Board, would be much longer procurable at par. After referring to the retirement from the board of Sir Wm. Forwood, who had given long and valued services as chairman of the company, and to the election of Mr. Joseph U. Hodgson as a director, the chairman gave hearty acknowledgment of the capacity, industry, and energy displayed by the engineer and general manager, Mr. E. J. Neachell. The entire staff of the railway had gone through an extremely busy year with great credit, and they had happily been entirely free from serious accidents. Before concluding he referred to a subject that had been freely discussed lately, the question of cross-river traffic between Liverpool and Birkenhead, and whether this should be further catered for in the shape of a tunnel or a bridge across the Mersey. That did not at the moment directly affect their interests, but it might do so ultimately, both as to traffic and local taxation, if the Corporation of Liverpool should decide on adopting either of the schemes spoken of. If they looked at the question from a financial point of view, they should remember that no competent person had expressed the opinion that either tunnel or bridge was likely to pay reasonable interest on the capital sunk in the enterprise. The Mersey Tunnel Railway already existing, carried in 1913 about the same number of passengers as the Overhead Railway, but its total capitalisation was over 3½ millions, as against rather less than one million in their own case, and the results to the original shareholders did not tend to encourage the construction of a second tunnel.

The report was adopted.

Metropolitan District Railway Co.

The annual meeting was held at the Westminster Palace Hotel on Thursday of last week, the Rt. Honourable Lord George Hamilton, G.C.S.I., in the chair.

The Chairman, in moving the adoption of the report (see Electrical Review, p. 323), said that owing to the change in the form of the accounts it had not been possible to give detailed comparisons between the accounts and statistical returns of the present and preceding years. Whilst therefore it had not been practicable to make detailed comparisons in the accounts themselves, they had been able to adjust the 1913 figures on the basis of the 1912 figures. Those comparisons showed that the gross receipts on revenue account amounted to £709,558, being an increase of £18,648 or 2.7 per cent. over the receipts for the corresponding year. The passenger receipts amounted to £670,636, an increase of £17,966 or 2.75 per cent., whilst the average receipt per passenger was 1.82d., which was exactly the same as for the corresponding period. The working expenses increased by £14,666 over the corresponding period, or 5.06 per cent. This increase was principally due to the increased cost of coal, namely £5,442; increases in the wages of the staff, due to new and improved conditions of service, approximately £7,000; National Insurance £1,040; whilst rates went up £488. The car mileage on the District Railway proper increased by 44,773 or 0.27 per cent., whilst the passenger receipts per service car mile was 10.039d. or an increase of 2.66 per cent. over the corresponding period. The percentage of operating expenses to gross receipts was 42.95 per cent. compared with 41.98 per cent. for the corresponding period. Referring to the accounts, the Chairman said that comparing 1913 with 1912, they were able to pay ¼ per cent. more on the second preference stock, and carry forward an enhanced balance of £4,130. A considerable improvement had been effected during the year in the work connected with the flying junctions at Earl's Court. These improvements enabled them to handle expeditiously and without stoppage the increased volume of traffic. The work at Charing Cross Station would be very shortly completed, when a really effective means of interchange would be established between the railway and the Bakerloo and Hampstead lines, and he thought the station must become a large exchange centre for passenger traffic between the above-mentioned railways. Looking back at the somewhat abnormal circumstances of the past year, he did not think they need be dissatisfied with the results obtained. The price of coal was exceptionally high, and the weather during the last six months abnormally warm and fine and consequently prejudicial to underground travel. They also had to meet for the first time the full cost of the Insurance Act, and the conditions of service of certain classes of their employees had been improved. Such increases of expenditure from time to time were unavoidable, and where the revenue against which they were charged was, from the nature of the enterprise, constant rather than elastic, they temporarily curtailed the record of increased profit. The fact that the District Railway carried no freight and was only a passenger railway of limited dimensions made the development of its revenue much slower than was the case with companies carrying both freight and passengers for long distances; but whilst the growth of the revenue was slower, it was less liable to fluctuations. The past year's experiences confirmed previous hopes that, though slow, the progress was unbroken and should so continue to be.

Mr. W. H. Brown seconded the motion and the report was adopted.

London Electric Railway Co.

The Right Hon. Lord Farrer (chairman) presided on February 19th at the Westminster Palace Hotel over the ordinary general meeting of the above company.

In moving the adoption of the report (see Elec. Rev., p. 321) the Chairman referred to the change in the form of the accounts and statistical returns owing to the new rules presented by railway companies, and also mentioned the capital powers given under the Companies' Act of 1913. During the year £36,923 of debenture stock was issued and sold, the proceeds of which were used towards the payment of the costs of extensions to the railways. Temporary loans were obtained from their bankers of £200,000 on the security of £260,000 of debenture stock, but in January, 1914, £404,971 of debenture stock was sold, and out of the proceeds the temporary loans had been repaid, and the balance placed the company in a satisfactory financial position. The capital expenditure for the year was £638,074. Of this amount on lines open for traffic £71,368 was expended in connection with the Paddington extension, which was opened for traffic on 1st December; the results from operation had so far been encouraging, and showed that the linking up of the great termini of London was useful alike to their undertaking and to the public. £34,622 had been expended on the improvements at Oxford Circus station, where escalators were being installed and provisions made for a concourse booking hall at the basement level, thus freeing the ground floor area which was being let on very advantageous terms. £806 had thus far been expended on escalators which were being installed in conjunction with the Metropolitan Railway Co. at Baker Street station. On lines belonging to the company not yet open for traffic there had been expended at Charing Cross £114,209, and it was hoped that these works would be finished early in March, when the complete transformation of traffic facilities at that spot should begin to materially help the revenue. Further lands had been acquired for the Edgware and Hampstead extension necessitating an expenditure of £22,881. On the Richmond extension £4,580 had been expended, and on the Queen's Park extension £351,925. £23,833 had been expended on electric power stations, etc., on miscellaneous improvements and additions. When all improvements which were now being carried out had been constructed and completed the railway would be linked up with other existing railways in a comprehensive manner and would enable passengers to take advantage of the convenient means of interchange from one railway to another and from all parts of London with rapidity and the least possible inconvenience. The estimate of further expenditure on capital account was £219,400. The estimated cost of works not yet commenced and in abeyance was £1,156,500 which comprised the cost of the extension to Richmond, the extension from Golder's Green, and the linking up of the City and South London railway at Camden Town with the Hampstead line. The capital powers and other assets available to meet these expenditures were £2,160,596. The gross receipts had amounted to £715,319 being a decrease of £3,293 or 0.46 per cent. compared with the receipts for the corresponding year. The expenditure had increased by £14,858 or 4.67 per cent. Of this amount upwards of £4,000 represented increase in wages due to new and improved conditions of service, and £640 for National Health Insurance. £9,000 was represented by increased cost of coal. Rates and taxes had increased by about £500. The car mileage showed an increase of 645,600 miles or 3.47 per cent., while the passenger receipts per car mile were 8.85d. compared with 9.18d. for the corresponding year. The percentage of operating charges to gross receipts were 43.61 compared with 41.64 for the corresponding period. During the year nearly 96,000,000 passengers (excluding journeys by season ticket holders estimated at 4,500,000) had been carried at an average fare of 1.70d. per passenger. He could not end his remarks without paying a tribute to the managing director, Mr. Stanley, and all the officers and staff for the manner in which the work had been and was being carried out. Some of their pictorial advertisements to-day were almost a new National Gallery in themselves. Railway Directors came in for a good deal of criticism at the present day. They obviously could not attend to the details of daily operation, but they could see that these were efficiently performed. The management of the lines were always desirous to please the public and ready to welcome suggestions for improving services or accommodation, subject of course to the necessary financial exigencies. The price for transportation in London was exceedingly moderate, and he asked those who were ratepayers to consider the enormous saving to the London ratepayer that had been made by private enterprise working underground railways, in cheap transport for the masses, and the improvement to the health of the community which resulted by enabling workers to obtain a larger area for their residence. They hoped and believed that as the traffic needs of London increased, so their railways would prosper and enable them to continue the same policy with the full financial success that such an enterprise certainly deserved.

Sir Algernon West seconded the motion and it was adopted.

Subsequently a special meeting was held, and resolutions approving of the Bill deposited by the company in Parliament, were carried.

Paisley District Tramways Co., Ltd.

The annual meeting was held at 83, Cannon Street, E.C., on February 19th, Mr. Owen Hugh Smith presiding.

The Chairman said that the directors had only to report that the traffic had increased very satisfactorily and that all the additions to the profit had gone to the maintenance of the tramways system and roadway. That was a trouble that they would always have to face. The result of the year's working was that the revenue amounted to £62,876, and the expenses to £41,475, leaving a balance of £21,400. The Chairman, having referred to the manner of dealing with this (see Electrical Review, p. 281), said that the traffic receipts showed an increase of £4,129, and the expenses an increase of £5,807 as compared with the receipts and expenses for 1912. The increase in expenses, although partly due to running an additional service of cars and the increase in the local rates, was mainly owing to increased cost for the maintenance of the track and roadway. This was largely due to damage caused by the increase in the heavy traffic of motor lorries and other heavy traffic. The matter was engaging the very serious attention of the directors, but they regretted to say that during the current year they did not anticipate any relief in this respect. A dividend on the ordinary shares was paid for the first six months of the year at the rate of 2 per cent., but owing to this heavy expenditure they thought it advisable not to pay any further amount this year but to increase the carry forward.

Mr. John Young seconded the motion.

In the course of a conversational discussion which ensued, and which was joined in by Mr. Young, Mr. W. M. Murphy,

and the Chairman, it was stated that the company paid everything out monthly and provision was made in the sinking fund for any repairs and maintenance. It was pointed out that the company had not yet got through half its life, and the directors were trying to make good out of revenue the items of depreciation of stock, repairs, etc. The only increase practically in the cost of working expenses had been in regard to the rates and taxes, but there had been an increase in the cost of repairs. On the question of the renewal of the lines, the opinion was expressed that when that had to be done the cost would be about £5,000 a mile. It was urged that it was a great pity that people who helped to wear out the lines could not be made to help them in renewing them, and it was suggested that if this course was carried out it would be the local authorities who would have to do it. They had as heavy motor traffic over their lines as was to be found in any part of England, and the Chairman expressed the opinion that it would be impossible to find any part of England where people suffered more in this respect, as very heavy boilers and other heavy traffic passed over the tramways and on the tramway track. In making a new track it would undoubtedly be necessary to have at least eight inches of concrete, although he believed that it was considered that six inches was generally enough for ordinary traffic.

The motion was adopted.

Central London Railway Co.

Lord George Hamilton took the chair on February 19th at the annual meeting held at the Westminster Palace Hotel.

The Chairman, in moving the adoption of the report (see Electrical Review, p. 322), said that owing to the new form of accounts they had not attempted the customary comparisons between the working of the current and the preceding years. The Liverpool Street extension was opened and in working order in July, 1912. In making the comparisons he proposed to do, it must be borne in mind that the year 1913 had the benefit, so far as the passenger receipts were concerned, of the working of the extension for the whole year as against five months only of 1912. Working expenses, on the other hand, were relatively increased in 1913 as against the preceding year. The receipts from passengers had given them an increase of £3,260 over the preceding year, parcels £195, and miscellaneous receipts £2,368. On the other hand, they had received £3,112 less from general interest. As a result they got a net increase for the year of £2,771. The working expenses amounted to £147,780, and the net receipts were £107,056. To this had to be added £36,502 for miscellaneous receipts, and, including the total brought forward from 1912, viz., £27,218, they got a total of £170,776. After making the provisions and payments mentioned in the report there would be left a balance of £20,878 as against £27,218 carried forward from the preceding year. During the year they had consumed 28,918 tons of coal, as compared with 26,384 tons, an increase of 2,534 tons. The cost was £18,426 against £16,714, an increase of £1,712. The number of passengers carried was 37,505,424 as compared with 35,939,202, an increase of 4.36 per cent. The working expenses were 58.56 per cent. of traffic receipts as against 57.99 per cent., an increase of .57 per cent. The capital account gave the amount of the nominal capital authorised and created, showing a balance of unissued capital of £750,000 and £250,000 borrowing powers. The share capital and stock created was the same as last year, but there had been a further conversion of ordinary into preferred and deferred stock. The amount expended during the year 1913 on capital account had been £67,749, the main item being the Liverpool Street extension £38,230. The Ealing extension cost £9,031. The estimate of further expenditure on capital account, excluding the Gunnersbury extension of £802,000, which was still under consideration amounted to £189,540. Of this, £91,000 was the estimated cost of the Ealing extension, for which a tender had been accepted, and £69,000 for additional rolling stock. The working of the railway during the year had not been associated with any incidents of exceptional importance. The weather during the latter part of the year was exceptionally fine and therefore not conducive to underground travel, and an investigation of the receipts of the various stations on the line presented the same phenomena as were associated with the working of the other tube railways. The traffic between intermediate stations did not increase rapidly, but for long distances or where there were good exchanges, the railways held their own. It was clearly, therefore, the policy of all enterprises of this nature to have terminal stations located on sites where there was a large and constant daily inward and outward flow of passengers. He had no doubt that the receipts of this line would be considerably augmented when the continuation to Ealing was completed and in working order. The service on the line had been punctual and was popular, and although he could not hold out hopes—looking to the limitations imposed upon their traffic by competition—that there would be a great expansion of profits, he saw no reason why they should not continue during the next few years to steadily improve their position.

The Hon. A. H. Mills seconded the motion.

Answering a question by Mr. Tate the Chairman said the letting of the contracts for the Ealing extension had been practically completed, and it was hoped that their trains would be running to Ealing within about a year.

The report was adopted, and subsequently the meeting passed a resolution approving of (1) the Bill to empower the Central London Railway Co. to enlarge a portion of their railway, tunnels, etc., and (2) a Bill to empower the London Electric Railway Co. to construct new subways, etc.

Bristol Tramway and Carriage Co., Ltd.

Sir George White presided at the yearly meeting of the Bristol Tramways and Carriage Co., held on February 18th, at Bristol. He expressed satisfaction that the report and accounts bore evidence of substantial progress. The gross revenue for 1913 amounted to £423,816, made up of £243,700 from tramways, £174,700 from carriages, and £5,400 miscellaneous. With the great extension of business it was natural that some items should show an increase, such as wages of staff, £10,573; coal, petrol, and traffic stores, £14,500; and in general expenses £6,730. This last sum was chiefly made up of three items—£2,121, compensation; £1,147, employés superannuation fund, provident society, and medical aid; and £2,123, rates and taxes. Rates and taxes now amounted to no less than £13,147. They paid the Bristol Corporation alone nearly £10,000 a year, and if some of the enterprising councillors would take the trouble to compare this with the absolutely absurd and inadequate rating of their docks and electric light undertaking and impart their knowledge to the ratepayers, it would be more generally understood that the company's rates were a real levy in aid of the city purse, and not a mere pretence, as in the case of municipally owned concerns. Again, by undertaking their part of the maintenance of the streets the company saved the ratepayers £20,000 or £25,000 a year. Sir George asked them to assume that the Corporation had owned the tramways when the motor business began to develop, and asked did they imagine the Corporation would have permitted it to do so? The company, on the other hand, had started a great industry that meant huge expenditure and employment for 1,500 men, in addition to the 1,500 on the tramways. Sir George then alluded to some of the figures given in the report published in the Electrical Review for February 13th, and spoke with pleasure of the fact that they were paying 5 per cent. as the final half-year's dividend, and on their having got out of the 4 per cent. stage. Without making rash promises, he thought they might look hopefully to not having to retrace their steps in that direction. Reference was then made to the success of the motor omnibus service, and next the speaker touched on the Bristol Corporation Bill giving the municipality power to work the tramways they might acquire. This Bill was premature and without precedent, and in a few weeks' time the company would place their case against it before the House of Lords. They would go into the committee room confident in the strength and justice of the company's case. The report was adopted and a final dividend for the half-year at the rate of 5 per cent. per annum declared. Sir George White, in a subsequent speech, said the whole situation was very complex and difficult, and he asked the shareholders to be confident that the best would be done on their behalf.

Underground Electric Railways Co. of London, Ltd.

The directors report that the results of the year ended December 31st, 1913, are as follows:—

The net revenue from investments and properties (including general interest), after deducting general expenses and including balance brought forward, amounted to £623,838; the service of the 4½ per cent. Bonds of 1933 required £84,488, leaving a surplus of £539,350, which will be applied as follows: Payment under the guarantee on Central London Railway Co. Assented Stocks for the year, £26,830; interest at the rate of 6 per cent. per annum on £1,273,000 6 per Cent. First Cumulative Income Debenture Stock for the year, £76,380; interest at the rate of 6 per cent. per annum plus Income Tax on £6,136,050 6 per Cent. Income Bonds of 1948 for the year, £390,970, leaving a balance to carry forward of £45,179.

Under the terms of the respective Trust Deeds, the Auditors have certified that the profits of the Company are sufficient to pay, for the year ended December 31st, 1913, the full interest at the rate of 6 per cent. per annum on the 6 per Cent. First Cumulative Income Debenture Stock, and full interest at the rate of 6 per cent. per annum plus income tax, on the 6 per Cent. Income Bonds of 1948. The interest on the 6 per Cent. First Cumulative Income Debenture Stock and Coupon No. 12 off the 6 per Cent. Income Bonds will be payable on and after March 2nd, 1914.

The report proceeds to refer to the progress of the various associated railway companies, whose statements have already appeared in our pages; also with the L.G.O. Co., the Associated Equipment Co., and the New Central Omnibus Co.

In accordance with the arrangement set forth in the last report, the exchange of the shares formerly held by this company in the London United Tramways, Ltd., for shares in the

London and Suburban Traction Co., Ltd., was duly carried out. The results of the latter company for its first year may be considered as satisfactory.

The main provisions of the London Electric Railway Co.'s Bill are :—

Construction of subways and escalators (*a*) at the company's Tottenham Court Road Station, (*b*) at the Company's Piccadilly Circus Station, and (*c*) at the company's Trafalgar Square Station; acquisition of lands for general offices; agreements with the Metropolitan District Railway Company, the City and South London Railway Company, and the Central London Railway Company in reference to construction, maintenance, occupation and user of subways, passages, escalators, offices and buildings; power to raise additional share and loan capital and to apply capital to purposes of Act; power to issue (with sanction of a resolution of a general meeting of the company) additional capital and unissued capital authorised by former Acts, with preferential dividend not exceeding 5 per cent.; payment of interest out of capital during construction; power to charge to Capital Account interest on Debenture Stock during construction of subways.

The main provisions of the Central London Railway Co.'s Bill are :—

Power to enlarge the running tunnels in High Holborn, power to the Central London Railway Company on the one hand and the District Railway Company, the City and South London Railway Company and the London Electric Railway Company or any of them on the other hand to enter into agreements with reference to the construction, maintenance, ventilation, erection, occupation and uses of subways, passages, escalators, offices, and buildings for and in connection with carrying on their respective undertakings; power to acquire additional lands and raise additional capital.

In the balance-sheet the item "Stocks, Shares and Other Property" stands at £13,593,696, and consists of stocks and shares in associated companies, as well as lands and buildings.

	Dec., 1911.	Half-year ended June, 1912.	Dec., 1912.	Year ended Dec., 1913.
Metropolitan District Railway—				
Passengers	39,897,061	42,910,560	43,092,589	89,438,332
Receipts	£300,625	£325,434	£327,236	£686,177
London Electric Railway—				
Passengers	48,666,842	51,691,661	49,190,925	100,263,755
Receipts	£342,451	£363,325	£350,304	£709,872
Central London Railway—				
Passengers	—	—	—	37,505,424
Receipts	—	—	—	£250,257
City and South London Railway—				
Passengers	—	—	—	22,723,856
Receipts	—	—	—	£145,652
London General Omnibus—				
Passengers	—	221,032,378	266,169,251	580,205,335
Receipts	—	£1,217,207	£1,467,122	£3,191,205
Total—				
Passengers	88,563,903	315,634,599	358,452,765	830,136,702
Receipts	£643,076	£1,905,966	£2,144,662	£4,983,163

Calgary Power Co.—The report for 1913 states that the gross earnings amounted to $240,116, as compared with $191,846 for 1912, showing an increase of 25 per cent. for the year. The net earnings amounted to $188,060, compared with $151,707, being an increase of 24 per cent. After deducting net interest charges amounting to $100,034, $88,026 was transferred to surplus account, being equivalent to 4¾ per cent. on the common stock. The sum of $9,000 was transferred to reserve account, leaving the balance at credit of surplus account $155,655. The fourth unit at Horseshoe Falls plant was installed during the year, bringing the equipment at that point up to its ultimate capacity. An entirely new plant was installed by the company's forces during 1913 at the Kananaskis Falls, a distance 2 miles above the Horseshoe Falls development, and the first 6,000-H.P. unit was put into service on December 27th. The other 6,000-H.P. unit is now being installed, and should be ready for operation in February, thus completing all construction work at present in hand. Duplicate transmission lines to Calgary are now in successful operation and a third line to Exshaw was installed during the year for the purpose of avoiding any possible transmission trouble. When the Kananaskis plant is in full operation, which will be about the middle of February, the earnings should show a substantial increase, as the company will then be in a position to fill all requirements for power and provide efficient and satisfactory service to its customers. During the year a new contract was entered into with the city of Calgary on terms mutually satisfactory to the company and the city. In order to provide the necessary funds for the new development, the directors have sold during the year £205,300 of bonds, bringing the amount issued up to £616,400.—*Financial Times.*

New York Telephone Co.—The report for the year 1913 shows (says the *Financial Times*) net telephone earnings $11,996,605, to which must be added dividends and interest earnings $5,770,394, and miscellaneous earnings $15,278. Total $17,782,278. Deducting interest $3,494,694, and adding surplus January 1st, 1913, $14,666,002, there is a credit balance of $28,953,586. The directors have declared dividends amounting to 8 per cent., placing to reserve for contingencies $2,500,000, miscellaneous items $37,817, leaving a surplus of $16,415,768. On December 31st, 1913, there were 1,082,765 stations in the system directly operated by the company and its local connecting companies, an increase during the year of 96,985. Including the associated and connecting companies, there were in service in the whole system at the end of the year 1,931,984 stations, an increase during the year of 175,641 stations. Under the plan for employés' pensions, disability benefits and insurance, adopted January 1st, 1913, there has been paid out from the fund during the past year $224,439. The interest added amounted to $76,358, leaving a balance of $148,081, which has been appropriated to restore the fund to its original amount of $2,000,000.

Mackay Companies.—The regular quarterly dividends of 1 per cent. on the preferred shares and of 1¼ per cent. on the common shares are announced.

Lancashire United Tramways, Ltd.—The directors report that the result of the working of this and the operating companies comprised in the company's system worked out as though they were one combined undertaking, shows traffic receipts £81,908, miscellaneous receipts £5,653, a total of £87,561. Working expenses absorbed £51,039, general charges £5,362, and rent of leased lines £5,041, leaving £26,119. Adding the dividend on holdings in the new St. Helens and District Tramways Co., Ltd., the profit of the combined undertaking is £27,653. The receipts, compared with those of the previous year, show an increase of £11,465, which includes an increase of £1,072 from the sale of electrical energy. The traffic earnings amounted to 9·04d. per car-mile. The increase in expenditure amounted to £3,278. This was due principally to the working of the Little Hulton and Farnworth extensions, the increased output of electrical energy to outside consumers, and to a further advance in the price of fuel. The interest and dividends received by this company from the operating companies, together with sundry receipts, amounted to £13,936. After deducting interest on the prior lien debenture stock and expenses, there remains £158, which has been carried to depreciation account, and there is also an undivided surplus on the year's working of the operating companies, after payment of interest and dividends before mentioned, of £14,994. The depreciation and renewal accounts and amounts carried forward in the combined companies amount to £29,290.—*Financier.*

Minehead Electric Supply Co., Ltd.—The directors report that there was a satisfactory expansion of business during the year ended December, 1913, the total units sold amounting to 220,969, as compared with 181,417 in 1912. The greater part of the increase has been for heating and cooking. The plant has been well maintained, and a large suction gas plant has been added. The profit on trading, after payment of interest on debentures, &c., amounts to £1,742 plus £11 brought forward. Deducting income-tax £41, and dividend on preference shares for the year £453, there remains £1,259, out of which a dividend of 8 per cent. per annum on the ordinary shares (less tax) is to be paid, absorbing £201, bonuses to managing director and manager and secretary, £77, placing to depreciation and reserve fund (making same £3,000) £960, carrying forward £21. Mr. R. H. Holman, a director of the company since its formation, has resigned. Mr. J. B. Marley, of Minehead, has been elected to fill the vacancy.

Telegraph Construction and Maintenance Co., Ltd.—The directors' report for 1913 states that there was a net profit of £114,863, after charging the interest on the debentures. Adding £106 637 brought forward, there is a total of £221,500. From this is deducted the interim dividend of 5 per cent., amounting to £22,410, leaving £199,090 to be dealt with. Of this the directors propose to distribute a further dividend of 10 per cent., together with a bonus of 12s. per share, absorbing £67,230, and to supplement the reserve fund by £20,000 (making it £125,000), leaving £111,860 to be carried forward. The general business of the company during the past year has been satisfactory. The works and steamships have been maintained in their usual state of efficiency. The meeting was held yesterday.

Llanelly Electric Lighting and Traction Co., Ltd.—The directors' report states that the available profit, including the balance brought forward, is £12 939, and after payment of loan and debenture interest there remains £9,179; out of this the following appropriations have been made :—Transfer to general reserve £1,000, to reserve for depreciation £1,000, to renewals account £1,500, leaving £5,679, which less interim dividend on preference shares to June 30th, 1913, leaves £3,879. It is proposed to pay the dividend on the 6 per cent. cumulative preference shares for the half-year to December (£1,800) and to carry forward £2,079. The result of the year's trading is considered satisfactory. In future the preference dividend will be paid half-yearly, on March 1st and September 1st.

Carmarthen Electric Supply Co., Ltd.—The directors report for the year ending December 31st 1913, a profit of £1,067 after providing for all charges against the working. They have paid an interim dividend on the preference and ordinary shares at the rate of 5 per cent. per annum. After paying interest on the debentures, &c., and the interim dividend, and setting aside the sum of £300 as a reserve fund for renewals of plant, there remains £326, out of which the preference dividend has been paid, and a further dividend at the rate of 5 per cent. per annum on the ordinary shares for the second half-year is recommended, leaving £218 to be carried forward. The number of consumers has increased from 250 to 374, and these are still being added to.

Cairo.—A *Financial News* dispatch from Cairo states that for the first time the Cairo Electric Railways and Heliopolis Oases Co. will not pay any dividend. This company reckons among its directors well-known London people who represent important English interests. The chief reason of the lack of dividend seems to be the fact that last year the company was unable to sell much land. It has also been defeated in its action against the Egyptian Government for obtaining exemption from certain taxes, which consequently had to be paid in 1913 in one single stroke.

Brompton and Kensington Electricity Supply Co., Ltd.—The directors, after appropriating to depreciation and sundry reserve accounts £12,669, recommend a final dividend on the ordinary shares at the rate of 11 per cent. per annum, making 10 per cent. for the year, £7,232 to be carried forward. The dividend for 1912 was at the same rate.

Compania de Electricidad de la Provincia de Buenos Aires, Ltd.—The directors' report for the year ended July 31st, 1913, as given in the *Financial Times*, states that the gross profit amounts to £80,340, which compares with £66,799 for the preceding year, showing an increase of £13,541. The administration and general charges in Buenos Ayres were £20,037, as against £21,073. This figure includes £5,396 for interest and discounts, which will be materially reduced during the present year. The average ratio of the working expenses for the year has been reduced to 54¾ per cent., and the directors anticipate that in the current year it will not exceed 50 per cent. During the year £88 314 has been expended on capital account in increasing the capacity of some of the power houses, as well as in the purchase of land, and erecting and equipping the two new stations at Ramos Mexica and Caseros, the first of which was inaugurated in November last by the municipal authorities. The directors have again appropriated the whole of the balance of the revenue account to depreciation, which amount represents all the provision that can be made at present, but the directors trust that in future years the annual revenue will be able to bear the full charge that may be found necessary in that connection.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to :—

Anglo-Argentine Tramways Co., Ltd.—Scrip, fully and partly (£20 per cent.) paid, for a further issue of £1,500 000 5 per cent. debenture stock.

British Columbia Electric Railway Co., Ltd.– Further issue of £240,000 deferred ordinary stock, £240,000 preferred ordinary stock; and £240,000 5 per cent. cumulative perpetual preference stock.

To appoint a special settling day in :—

Georgia-Carolina Power Co.– Fully-paid scrip for $500,000 5 per cent. first mortgage 40-year sinking fund gold bonds.

And to allow the following to be quoted in the official list :—

Metropolitan Railway Co.– £975 000 consolidated ordinary (deferred dividend) stock and £75 000 8½ per cent. "A" preference stock (ranking for dividend from July 1st, 1916).

Underground Electric Railways Co., of London, Ltd.– Further issue of £21,400 4½ per cent. bonds of 1888 for £100 each, Nos. 17,448 to 17 061.

Wycombe (Borough) Electric Light and Power Co., Ltd.—The directors' report shows that during the year ended December 31st, 1913, further progress has been made, the connections having risen to 65,250, an increase of 1,745 equivalent 8-c.p. lamps. The result of trading, including £56 brought forward, shows a profit to the credit of net revenue account of £6,298, and after paying interest on debentures and outstanding accounts amounting to £3,129, there remains £3 169 available for distribution. A dividend at the rate of 2½ per cent. for the year is recommended, and will absorb £1,000; £2,000 is to be placed to reserve fund for renewal account, leaving £169 to be carried forward. The meeting is to be held on March 3rd.

Tramways Light and Power Co., Ltd.—The directors announce a dividend at the rate of 6 per cent. per annum on the preference shares for the half-year. A meeting of the company was held yesterday.

STOCKS AND SHARES.

Tuesday Evening.

MARKETS in the Stock Exchange have relapsed into much the same condition of depression, combined with stagnation, that characterised them during the greater part of 1913. This is all the more disappointing, because of the promise of better business which came with the beginning of the current year. In place of the buoyant optimism which then ruled, there has arrived a gloomy pessimism that is probably unjustified, and which the course of events will prove to have been overdone. The money market naturally tends to become harder towards the end of the quarter, but when a few more stale "bulls" have cut their losses, the way should be open to improvement in prices. For there is plenty of capital about, and investors are only holding their hands at present in strict accordance with the usual precedent, which makes them refuse to buy when things are depressed, and to take a ready hand when markets are on the mend.

The heated discussion which continues to rage around Lord Claud Hamilton's statement that the Great Eastern Railway was forced to go to the United States for a new general manager, has done the market no good. It is contended that the Great Eastern has added another disturbing ingredient to the ferment of Labour discontent which is always on the simmer. Prices have fallen substantially in all departments. Metropolitans slumped to 43, but recovered to 44½, leaving them ½ down on the week; while Districts are 1½ lower at 31. To this latter result the report of the Underground Electric Railways contributed indirectly. Better things had been expected, and Underground Electric £10 shares dropped 7s. 6d. to 3, while both classes of bonds are a point lower.

The acrimonious controversy which has been going on around the board of the Metropolitan Railway Company apparently led to sales on the part of some of the more timid holders, although, so far as can be seen, there was no special reason for this. London Electric Railways issues are steady, the report having little effect. London and Suburban Debenture stock is easier, and British Electric Tractions are also down, except the 5 per cent. Debenture stock, which gained ½. Another 2 points rise carried Lancashire United Debenture to 86, and Metropolitan Electric Tramways Debenture advanced to 94½. There was ¼ rise in Yorkshire preference shares.

The Electricity Supply list holds its ground with a good deal of steadiness. Bournemouth and Poole Ordinary and the Second Preference shares are both higher, upon an increase in the dividend on the former to 7 per cent. for the past year. London Electric Ordinary are also better, thanks to the dividend increase, and St. James's advanced to 10. Against these have to be set falls of ¼ in Westminsters and in South London Ordinary, while amongst the Debenture issues the only movement is a rise of 1 in County Seconds. Business in this market's shares has dwindled to meagre proportions, and the interest stimulated a little while back by the dividend anticipations has been dimmed by the drabness prevailing elsewhere. There seems little doubt that when the other markets get into a more bullish stride the firmness of Electric Lighting shares will be renewed.

Certainly dividend announcements from the London companies have been very satisfactory, and would appear to show that the changed conditions introduced by the metal-filament lamp are now working for the benefit of the companies, instead of otherwise. It is interesting to set out the results in tabular form :—

Share.	Dividend per cent. 1912.	Dividend per cent. 1913.	Increase per cent.	Present price.
Brompton and Kensington (£5) ..	10	10	—	9¼
Charing Cross (£5)	5	6	1	8⅛
Chelsea (£5)	4	5	1	5⅞
City of London (£10)	9	10	1	18⅝
County of London (£10)	6	7	1	13
Kensington and K'sbridge (£5) ..	8	9	1	8⅛
London Electric (£3)	2½	3	½	2
Metropolitan (£5)	4	4½	½	4
St. James's (£5)	10	12	2	10⅛
South London (£4)	5½	5½	—	3⅝
Westminster (£5)	10	10	—	9½

All the quotations are *cum* dividend, from which it will be seen that the returns average fully 5½ per cent. on the money.

Affairs in Mexico have become more complicated and more critical than ever, by reason of the murder of the Englishman, Mr. Benton. This indefensible action was deemed so grave as to make it certain that the Mexican trouble would be brought at once to a head. So many incidents, however, have been claimed in the past as links which made up an intolerable chain, and yet have failed to produce results ameliorating the situation, that it was feared the latest might also have similar indefinite consequences.

Mexico Trams are flat at 70½, and the Company's Second Bonds show a fall of 2. Mexican Light and Power Preference shares and bonds have both dropped about 3 points. Monterey Debenture shed 2, and Mexican Electric Light bonds went back to 65. The whole of this group has been depressed, suffering, in addition to its other troubles, heavy sales from Paris in connection with the financial difficulties in that centre. Rio Tramway bonds have fallen, British Columbia Deferred is easier, and Brazil Tractions dropped 3. Para Electric Railways issues are unchanged.

The Anglo-Argentine Tramways group is firm, but City of Buenos Ayres Trams shed another 1/16. The new Debenture issue of the Anglo-Argentine Tramways Company is quoted about ¼ discount.

From a correspondent we have received an inquiry with reference to Kalgoorlie Electric Power and Lighting Preference shares, the yield on which—namely, 12 per cent.– gives them an attractive appearance. Any return of such a nature is in itself a good reason for looking carefully into the security; while the fact that the 10s. Ordinary stand about 1s. 3d. is another warning signal that ought not to be missed. Kalgoorlie is a mining town, dependent upon an industry which in Western Australia has been none too flourishing for several years past, and anyone buying Kalgoorlie Electric shares now should recognise that he is embarking upon a very speculative proposition.

We have also been asked for an opinion about La Plata Trams, to which favourable consideration was given here some time ago. Since then, the company has been through a most unhappy time. It was discovered that heavy defalcations had taken place. The traffics, instead of showing that expansion which might reasonably have been expected, have proved disappointing, and the depression that has tinged most South American companies has also played a part in depressing the price of La Plata Trams. We fear the only thing to do is to await the course of events, but must add that the position is anything but satisfactory; while the misfortunes that have dogged the undertaking, and which arose after the shares were mentioned here, are sufficient to curb any desire to point out what may seem to be useful and profitable suggestions.

The Telegraph market is noticeable mainly for the fall of 10s. in Reuter's shares, which has taken the price to 9, and for a further slump in Marconis, due, of course, to the dragging out of the old scandal by reason of the debate in the House of Lords in connection with Lord Murray's purchases. The shares in the parent and in the subsidiary companies have all fallen. West India and Panamas lost ½, and Anglo-American Deferred again went back ½, thanks principally to the wave of depression that overspread stocks and shares with a speculative flavour. Mackay issues are good, on a little support from New York.

British Westinghouse Preference are one of the firmest features of the week, the price rising to 30s. and holding its gain. Edison and Swan slipped back to 2s. 6d. middle, and the rest of the fluctuations in this division consist mainly of small declines. Henley's retained their big rise of last week on the good dividend. The Rubber share market has been weakened by a fall in the price of the raw material, while this week's auction sale in Mincing Lane assumed fairly substantial proportions.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 24th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	¼ — ⅝	..	Nil
Do. 5 % Pref.	1	5	5	⅜ — ½	..	6 18 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	16 — 18	— ½	..
Do. Do. Deferred	100	..	..	7 — 9	— ½	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	90 — 93	..	6 9 0
Do. 7 % Non-Cum. Pr'f.	100	8	..	87 — 90	..	5 0 0
Do. 5 % Perp. Deb.	100	5	5	93½ — 96½	+ ½	5 3 6
Do. 4½ % 2nd Deb.	100	4½	4½	80 — 83	..	5 8 5
Central London Railway, Ord.	100	3	3	59 — 64	..	4 13 9
Do. Gtd. Assented	100	..	4	83 — 85	..	4 14 0
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	84 — 86	..	4 13 0
Do. Def.	100	2	2	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 2
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	97 — 99	..	5 1 0
Do. Do. 1898	100	5	5	97 — 99	..	5 1 0
Do. Do. 1901	100	5	5	96 — 97	..	5 3 1
Do. Do. 1908	100	5	5	98 — 95	..	5 5 0
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref.	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	67 — 72	..	6 5 0
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 3
Lancashire United, 5 % Deb.	100	5	5	85 — 87	+2	5 15 0
London and Suburban, Ord.	1	..	..	⅛ — ⅜	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅜ — ½	..	6 18 4
Do. Do. 4½ % 1st Deb.	100	4½	4½	79 — 84	—1	5 7 2
London Elec. Railways, 4 % Deb.	100	4	4	89 — 91	..	4 7 11
London United Trams, 4 % Deb.	100	4	4	63 — 67	..	5 19 5
Metropolitan Railway Consol.	100	1⅝	1⅝	44½ — 44⅝	—1	3 12 6
Do. Surplus Lands	100	2½	2½†	64 — 66	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	87 — 89	+1	3 18 7
Do. 3½ % Pref.	100	3½	3½	84 — 86	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	82 — 84	..	4 4 4
Metropolitan District Ord.	100	Nil	..	30⅜ — 31½	—1½	Nil
Do. 6 % Deb.	100	6	6	138 —141	..	4 5 1
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 3
Do. 4 % Prior Lien	100	4	4	97 — 99	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	89 — 91	..	4 19 0
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	93 — 96	+1	4 18 9
Do. 5 % Deb.	100	5	5	90 — 93	..	5 7 6
Potteries, Ord.	1	3½	..	⅜ — ½	..	..
Do. 5 % Pref.	1	5	5	1⅛ — 1⅜ xd	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	¾ — ⅞	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	2⅞ — 3⅛	— ⅛	Nil
Do. "A"	1/-	..	..	⅛ — ⅜	— 1/32	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	116 —118	..	5 1 7
Do. 4½ % Bonds	100	4½	4½	99 —101	—1	4 9 0
Do. 6 % Income	100	6	6	93½ — 94½	—1½	6 6 10
Yorkshire (West Riding). Ord.	5	Nil	..	7/32 — ¼	..	Nil
Do. 6 % Pref.	5	3	4	3⅞ — 4⅛	+ ⅛	4 11 5
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 6 0

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅞ — 5⅛	..	5 7 5
Do. 2nd Pref.	5	5⅜	5⅜	⅞ — 1	—1/16	6 0 7
Do. 4 % Deb.	100	4	4	92½ — 94½	..	4 4 8
Do. 4½ % Deb.	100	4½	4½	97 —100	— ⅛	4 10 0
Do. 5 % Deb.	100	5	5	96½ — 98½	..	5 1 6
Auckland Trams, 5 % Deb.	100	5	5	103 —106	..	4 14 3
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅞ — 11⅛	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 18 8
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	88 — 90	—3	6 13 4
Brisbane Trams Invt., Ord.	5	8	8	7⅜ — 8⅛	..	4 18 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
B. Columbia Elec. Rly., Def.	100	8	8†	120 —124	—1	6 9 1
Do. Pref. Ord.	100	6	6	107 —111	..	5 8 1
Do. 5 % Pref.	100	5	5	103½—106½	..	4 13 0
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	94 — 98	..	4 12 0
Do. 4½ % Con. Deb.	100	4½	4½	95 — 98	..	4 6 9
Calcutta Trams, Ord.	5	7½	5†	6 — 6¼	..	5 15 5
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	⅝ — ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5/16 — 5/8	—1/16	4 10 0
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	..	5 7 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie Elec. Trams	1	N	..	0 — 1/16	..	Nil
Do. 5% A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6% B Deb.	100	3	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord.	1	..	..	⅜ — ½	..	..
Do. Pref.	1	4½d.	6	¾ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1¼ — 1⅜	..	4 7 8
Do. 6 % Pref.	1	6	6	1⅝ — 1⅞	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	5 — 5⅜	..	5 11 7
,, Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 0
Manaos Trams & Lt., 1st Deb.	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 —100 xd	..	5 0 0
Mexico Trams Com	$100	7	7	69 — 72	—1½	..
Do. Gen. Con. 5 % Bonds	..	5	5	78 — 83	..	6 0 6
Do. 6 % Bonds	100	6	6	81 — 85	—2	7 1 2
Para Elec. Rlys. & Lt., Ord.	5	10	10†	4⅞ — 5⅛	..	9 6 0
Do. 6 % Pref.	5	6	6	4½ — 5	..	6 0 0
Do. 5 % 1st Deb.	100	5	5	93 — 95	— ½	5 5 3
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	100 —102	—1	4 18 0
Do. 5 % Mort. Bonds	100	5	5	92 — 94	—2	5 6 5
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	100 —103	..	4 17 0
Singapore Trams, 5 % Deb.	100	5	5	88 — 92	+1	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	97 — 99	..	5 1 0
Un. Elec. Trams Monte Video	5	7	7	4⅝ — 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 14 8
Do. 5 % 1st Deb.	100	5	5	94 — 97	..	5 3 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	10	6	7	9⅜ — 10⅛	+ ⅛	6 13 4
Do. 4½ % Pref.	10	4½	4½	8⅝ — 9⅜	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96	..	4 13 9
Brompton & Kensington, Ord.	5	10	10†	9⅞ — 9⅝	..	5 4 0
Do. 7 % Cum. Pref.	5	7	7	8⅝ — 9⅛	..	8 16 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	90 — 93	..	4 6 0
Charing Cross, West End & City	5	5	6	4⅞ — 5⅛	..	5 14 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4⅞ — 5⅛	..	4 13 0
Do. 4½ % Deb.	Stock	4½	4½	97 — 100	..	4 10 0
City of London, Ord.	10	9	10	18 — 19	..	5 5 3
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 3 4
Do. 4½ % Second Deb.	100	4½	4½	99 —102	..	4 8 1
County of London, Ord.	10	6	7	12⅝ — 13⅛	..	5 6 8
Do. 6 % Pref.	10	6	6	11⅝ — 12⅛	..	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	101½—103½	..	4 7 0
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	+1	4 7 5
Edmundson's, Ord.	£8	..	..	⅜ — ½	..	Nil
Do. 6 % Cum. Pref.	5	6	6	8⅛ — 8½	..	7 5 5
Do. 6 % Non-Cum. Pref.	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅞	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	91 — 93	..	4 18 9
Hove	5	8	8†	8⅜ — 9⅛	..	4 17 3
Kensington & Knightsbridge, Ord.	5	8	9	7⅞ — 8⅛	..	5 9 1
Do 4 % Deb.	Stock	4	4	89 — 91	..	4 8 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1½ — 2	+ ⅛	4 10 0
Do. 6 % Pref.	5	6	6	5 — 5⅜	..	5 11 7
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 8
Metropolitan	5	4½	4½	3⅞ — 4¼	¼	5 9 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5	..	4 10 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	97 —100	..	4 10 0
Do. 3½ % Mort Deb.	Stock	3½	3½	83 — 86	+1	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 —103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅞ — 10⅛	..	5 14 3
Oxford	5	7	7†	6 — 6¼	..	5 7 8
St. James' and Pall Mall, Ord.	5	10	12	9⅞ — 10⅛	+ ⅛	5 17 1
Do. 7 % Pref.	5	7	7	6⅝ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	82 — 85	..	4 2 4
South London, Ord.	4	5⅜	5⅜	3⅞ — 3¾	— ⅛	6 1 9
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1⅞ — 1⅞	..	5 14 9
Do. 4½ % First Deb. Stock	100	4½	4½	94 — 97	+1	4 18 9
Urban, Ord.	£8	Nil	..	⅜ — ½	..	..
Do. 5 % Cum Pref.	5	3‡	..	3¾ — 4¼	..	4 12 0
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 89	..	5 1 3
Westminster, Ord.	5	10	10	8⅞ — 9⅜	— ⅛	5 6 8
Do. 4½ % Cum Pref.	5	4½	4½	5⅛ — 5⅜	..	4 4 8

* Unless otherwise stated all shares are fully paid. † Interim Dividend. ‡ 8s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 24th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5¼ — 5⅝	..	5 11 7
Calcutta, Ord.	5	8½	5†	7⅝ — 8	..	5 6 3
Do. 5 % Pref.	5	5	5	5⅛ — 5⅛	..	4 14 1
Calgary Power, 1st Mort. Bds.	100	5	5	90 — 92	+1	5 8 8
Canadian Gen. El. Com.	$100	7	8	112 —116	—1	6 18 0
Do. 7 % Pref.	$100	7	7	123 —128	..	5 9 5
Cordoba Lt., Power and T., Ord.	1	5	..	⅞ — ⅝	..	7 12 0
Do. 5 % Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	87½ — 89½	..	6 14 1
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	96 — 98	..	5 2 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅜ — ⅝	..	Nil
Do. 6 % Pref.	1	6	6†	⅝ — ¾	..	12 0 0
Kamnistiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	Nil	..	1⅛ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 —105	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	63 — 67	—1	7 9 8
Mexican Lt. & Power, Common	$100	4	4†	43 — 46	..	..
Do. 7 % Cum. Pref.	$100	7	7	80 — 85	—2½	8 4 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	76 — 80	—3	6 5 0
Do. 5 % 2nd Mort. Bonds	100	5	5	64 — 68	..	7 7 1
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	54 — 59	—2	..
Montreal, Lt., H. and Power	$100	9	10†	228 —233	..	4 5 10
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	103 —108	..	5 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	102 —104	..	4 6 7
Shawinigan Water, Capital	$100	5½	6†	144 —148	..	4 1 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	106 —108	..	4 12 7
Do. 4½ % Per. Deb.	Stock	4½	4½	98 —101	..	4 9 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	95 — 98	..	4 11 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	88 — 90	..	5 11 1
Victoria Falls Power, Pref.	1	6	6	⅞ — 1⅛	..	7 7 8
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 8

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	1⅛ — 1⅜	..	8 12 4
Do. 6 % Pref.	1	6	6	¾ — ⅞	..	6 17 2
Babcock & Wilcox	1	16	14†	3⅛ — 3⅜	+⅛	5 18 6
Do. Pref.	1	6	6	1⅝ — 1⅞	..	4 3 6
British Aluminium, Ord.	1	..	..	1⅛ — 1⅜	..	..
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1⅝	..	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	96 — 99	..	5 1 0
Do. Deb. Stk.	100	5	5	89 — 94	—1	5 6 5
B.I. & Helsby Cables	5	10	8†	8¾ — 9⅛	..	5 6 8
Do. Pref.	5	6	6	5⅞ — 6⅛	..	4 14 1
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	2	Nil	..	1⅞ — 1⅝	+ ⅛	Nil
Do. Deb.	100	4	4	68 — 71	..	5 12 8
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	39 — 43	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 18 4
Callender's Cable	5	15	5†	11¼ — 12½	..	6 2 4
Do. Pref.	5	5	5	4⅛ — 5⅛	+ ⅛	4 16 5
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	1	20	22½	23 — 27	..	..
Do. Deb.	100	4½	4½	103 —106	..	4 5 1
Crompton & Co., Deb.	100	5	5	83 — 85	..	5 17 8
Dick, Kerr	1	Nil	..	⅛ — ⅜	..	..
Do. Pref.	1	6	6	⅜ — ⅝	..	7 2 2
Edison & Swan, A, £2 paid	5	Nil	..	⅛ — ⅜	—⅛	Nil
Do. fully paid	5	Nil	..	1 — 1¼	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	⅝ — ¾	..	7 5 6
Do. Pref.	1	7	7	⅞ — 1⅛	..	6 11 7
Greenwood & Batley, Pref.	10	7	7	6½ — 7½	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	10⅛ — 10⅜	..	5 14 3
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	20	14 — 15	..	6 13 4
Do. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	7½	7½	11 — 12	..	6 5 0
Do. Pref.	10	5	5	8⅞ — 9½	— ½	5 5 3
Telegraph Construction	12	20	20	39 — 41	..	5 17 0
Do. Deb.	100	4	4	98 —100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 — 69	..	5 16 0
Do. B 4 % Cum. Pref.	100	..	..	50 — 55	—1	..

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	4½	6⅞ — 6⅞	..	6 18 4
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	..	5 3 0
American Telep. & Teleg., Cap.	$100	8	8	123 —126	..	6 7 0
Do. Collat. Trust	$1000	4	4	92 — 95	..	4 4 3
Anglo-American Telegraph	Stock	3	3	65 — 68	..	4 8 3
Do. 6 % Pref.	Do.	6	6	108⅜ — 109⅜	..	5 9 4
Do. Def.	Do.	30/-	30/-	24⅛ — 24⅝	— ½	6 1 10
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	103 —105	..	4 15 2
Chili Telephone	5	8	..	7⅞ — 7⅞	..	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	81⅜ — 83½	..	4 16 0
Cuba Telegraph	10	6	6†	8½ — 9⅜	..	6 8 1
Do. 10 % Pref.	10	10	10	15½ — 16⅜	..	5 19 5
Direct Spanish Telegraph, Ord.	5	4	4	3⅞ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	..	7⅜ — 8	..	6 5 0
Direct United States Cable	10	4	4†	6⅞ — 7⅜	..	5 8 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 — 99	..	4 10 10
Eastern Telegraph, Ord. Stock	Stock	7	7	134 —137	..	5 3 0
Do. 8½ % Pref. Stock	Do.	8½	8½	78 — 80	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97	..	4 2 4
Eastern Extension	10	7	7	12⅜ — 12⅝	..	5 8 9
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust	10	6	6†	11⅜ — 11⅞	..	5 1 1
Do. 6 % Pref.	10	6	6	12½ — 13	..	4 12 4
Great Northern Telegraph	10	20	5†	32½ — 34½	..	5 16 0
Indo-European Telegraph	25	13	5†	58 — 60	..	5 8 4
Mackay Companies Common	$100	5	5	86 — 90	+3	5 11 1
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	+2½	5 9 7
Marconi's Wireless Telegraph	1	20	20	3⅜ — 3⅛	—⅛	5 8 5
Do. 7 % Cum. Partic. Pref.	1	17	..	⅝ — ⅞	— ⅛	5 8 7
Monte Video Telephone, Ord.	1	6	6	⅛ — ⅛	..	6 8 0
Do. 5 % Pref.	1	5	5	⅜ — ⅝	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 — 101	..	4 9 0
Oriental Telep. and Elec.	1	10	10†	1⅛ — 2⅜	+⅛	4 11 4
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1½	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10†	8¼ — 9½	— ½	10 10 6
Submarine Cables Trust	Cert.	6	6	126 —129	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96⅜ — 98½	..	4 11 5
United River Plate Telephone	5	8	6†	6⅜ — 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 9 0
West Coast of America	2½	2½	..	1⅜ — 1⅝	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1½	1½	2⅞ — 2¼	— ⅛	4 13 0
Do. 6 % Cum. 1st Pref.	10	6	6	9½ — 10¼	..	5 17 0
Do. 6 % Cum. 2nd Pref.	10	6	6	9 — 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd.	10	7†	7	13⅛ — 13⅝	..	5 2 8
Do. 4 % Debs.	Stock	4	4	95 — 97	..	4 2 8
Western Union 4½ % Fdg. Bonds	$10.0	4½	4½	96 — 98	..	4 11 1

* Unless otherwise stated all shares are fully paid. † Interim dividend. a Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

Cheap Electricity for "Other Uses."—Three German linesmen have discovered that inventive genius is not always appreciated; they have been fined £2 in all for conducting researches. As is well known, the barges on the Teltow Canal are towed by electric locomotives taking current from an overhead wire. Having heard that fish were stupefied by electricity, the experimenters connected a wire net to the trolley wire and immersed it, apparently without themselves receiving any shock. The result was so successful that the inventors boasted loudly of it and were convicted of "unlawful fishing and theft of electrical energy."

Electricity in Jerusalem.—It is reported that two Greeks have obtained a concession for the electric lighting of the city of Jerusalem and the construction and working of an electric tramway. The constructional enterprise, the Omnium Co., which is supported by the banking firm of Perier & Co., of Paris, is seeking to secure a concession for an electric tramway from Jerusalem to Bethlehem, the transport of the water of the Wadai-Forah to Jerusalem, and the electric lighting of Jerusalem. As the last-mentioned concession is already held by Greeks, it is assumed that they will co-operate with the Omnium Co. in the extension of the proposed works.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JANUARY, 1914.

THE returns of electrical export and import business for the month of January show an improvement in the case of the former to the extent of £35,000, and a falling off of some £37,000 in imports, as compared with the previous month.

Thus the actual total of the January exports, £554,878, compared with £519,549 for December, and while it included considerably decreased amounts for telegraphic, telephonic, cable and lamp exports, the total value of machinery exported, *i.e.*, £304,000 approximately, was greatly in excess of anything previously recorded in our monthly returns. The only other increase of note in this section of the returns were the fittings exports, which were some £10,000 above the previous month.

The imports total of £258,175 compared with £294,844 in December, and included much smaller values for machinery, cable, lamps, &c., than in that month. A considerable increase occurred in battery imports, while telegraphic and telephonic imports were also slightly higher.

The re-exports for January amounted to £28,011, or, roughly, some £4,000 less than in the previous month. The month was an exceptionally good one for Indian business, while the South American countries, Australia and Japan were also good customers.

The imports from the United States into this country, which were brisk during the whole of last year, continue on the upgrade.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,243	272	42	276	793	400	4,626	3	387	159	22	3,066	11,289
Germany	2,208	3,499	127	...	416	187	3,021	...	60	...	299	12	9,829
Netherlands, Java and Dutch Indies ...	726	358	355	...	33	10	1,001	26	38	14	...	19,000	21,561
Belgium	2,059	377	245	34	11	48	1,293	...	145	15	1,298	42	5,567
France	717	...	4,337	...	...	...	14,126	48	134	...	336	67	19,765
Portugal	30	72	7	15	...	...	372	118	19	10	2,473	222	3,338
Spain, Canary Isles and Spanish N. Africa...	1,368	45	34	...	...	132	9,500	...	...	379	158	253	11,869
Switzerland, Italy and Austria-Hungary ...	222	60	179	...	15	244	7,087	55	...	470	22	1,654	10,008
Greece, Roumania and Turkey	265	61	231	22	...	...	188	70	38	...	239	474	1,588
Channel Isles, Gibraltar, Malta and Cyprus...	88	...	95	34	...	47	386	...	...	...	12	2,069	2,731
U.S.A., Philippines and Cuba	55	...	...	270	...	...	1,326	...	35	...	...	220	1,906
Canada and Newfoundland	1,153	...	1,980	644	...	695	13,074	5	243	16	64	2,599	20,473
British West Indies and British Guiana ...	65	...	64	26	...	...	12	...	20	...	2	13	202
Mexico and Central America	10	164	...	...	...	...	427	104	2	...	...	...	707
Peru and Uruguay	291	47	17	...	51	376	3,706	...	537	31	15	...	5,071
Chile	337	638	105	236	...	66	2,186	368	207	...	68	113	4,319
Brazil	1,782	2,064	1,070	164	...	883	17,980	2,645	470	...	494	1,477	29,029
Argentina	5,053	4,937	763	1,746	269	1,823	31,788	2,255	3,044	305	1,703	742	54,428
Colombia, Venezuela, Ecuador and Bolivia...	249	22	2,143	10	...	40	832	...	124	...	12	206	3,638
Egypt, Tunis and Morocco	89	296	27	26	15	20	1,113	326	198	37	592	1,136	3,875
British West Africa	127	57	75	44	...	...	635	...	62	...	292	138	1,430
Rhodesia, O.R.C. and Transvaal	2,128	555	112	696	...	20	3,772	39	38	38	...	23	7,421
Cape of Good Hope	1,760	3,957	440	354	46	179	12,654	26	651	13	6,061	1,535	27,676
Natal	767	7,581	295	152	321	7	3,690	4	166	58	283	1,333	14,657
Zanzibar, Brit. E. Africa, Mauritius & Aden	263	30	250	49	...	...	303	26	83	16	10	178	1,208
Azores, Madeira and Portuguese Africa ...	232	277	204	31	...	143	17,781	885	27	...	3	97	19,680
French African Colonies and Madagascar ...	111	12	44	...	...	65	...	...	...	...	...	...	232
China and Siam	920	816	4,112	130	46	438	4,979	390	22	11	275	69	12,208
Japan and Korea	1,390	665	1,225	272	36	499	27,125	505	209	...	1,355	142	33 423
India	4,586	10,022	4,603	2,250	25	1,967	59.976	8,113	...	124	3,109	1,917	96,692
Ceylon	1,024	292	241	38	...	4	1,128	48	992	...	265	...	4,032
Straits Settlements, Fed. Malay States, and Sarawak	202	678	452	22	65	404	1,536	501	8	107	615	511	5,101
Hong Kong	321	950	352	74	...	588	2,007	3	1,400	...	36	714	6,445
West Australia	541	265	176	69	24	161	1,071	19	43	...	2,750	...	5,119
South Australia	219	1,813	224	80	...	10	4,403	3	59	...	940	421	8,172
Victoria	394	3,696	1,824	1,243	135	1,338	9,427	...	782	24	577	7,361	26,801
New South Wales	1,789	4,430	534	2,125	206	862	11,605	1,705	781	76	4,596	3,196	31,905
Queensland	585	974	135	314	...	37	1,472	1,121	213	...	101	3,190	8,142
Tasmania	5	174	...	55	...	...	1,536	...	6	...	...	75	1,851
New Zealand and Fiji Islands	846	2.253	1,066	939	478	546	4,988	1,342	386	5	6,392	2,249	21,490
Total, £	36,220	52,404	28,185	12,440	2,985	12,239	284,132	20,753	11,629	1,908	35,469	56,514	554,878

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	25	...	...	6	90	125	2,207	3,304	563	...	12,623	18,943
Germany	3,982	23,480	2,364	9,832	7,066	9,460	48,052	8,502	5,501	9,177	5,694	133,110
Holland	6	48	19	514	673	...	75	389	...	18	...	1,742
Belgium	429	3,359	10	249	...	28	6,272	18	247	258	4,862	15,732
France	214	787	668	1,610	649	1,509	1,556	...	1,584	3,753	460	12,790
Switzerland	509	2,490	80	9	...	510	2,808	8	6	14	6	6,440
Italy	44	4,355	...	...	...	...	418	63	...	...	54	4,934
Austria-Hungary	...	593	...	177	...	...	...	...	231	...	120	1,121
United States	15,961	140	2,559	190	300	61	11,176	23,286	428	16	8,345	62,462
Total, £	21,170	35,252	5,700	12,687	8,778	11,693	72,564	35,570	8,560	13,236	32,164	257,274

Additional imports: Spain, carbons, £686; Canada, electrical goods, £150, glow lamps, £15, machinery, £50.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	8,836	683	...	1,422	310	...	14,958	...	536	604	659	28,011

TOTAL EXPORTS: £554,878 TOTAL RE-EXPORTS: £28,011. TOTAL IMPORTS: £258,175.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

THE GRADING OF ELECTRICIANS.

By H. R. TAUNTON.

It is doubtful whether the Electrical Trades Union has given any but the most cursory consideration to the economic questions involved in its demand for so large an increase as three-halfpence an hour. It is true that it is some years, during which the cost of living has largely increased, since any advance has been made in electricians' rates of pay; while other trades, whose work is no more difficult, and requires no greater skill of head and hand, rejoice in 11d. and 1s. an hour. These may be excellent motives for asking for an increase, but they provide no reasons for granting it. The only vital factor to be considered is, what is the real value of the average electrician's services to his employer, and through him to the community? That is the value the electricians will finally have to accept, in the absence of a union strong enough, as in the case of these other trades, to force an artificial rate upon the community.

The Electrical Trades Union, for basic reasons, is not likely to become strong enough to do the same for its members. Their work still largely ministers to a luxury, and is therefore particularly subject to trade cycles. Electric lighting and heating, and even power, can all at a pinch be dispensed with, in favour of their many rivals. Unless the Electrical Trades Union is in a position to guarantee the future prosperity of the country, the greatly increased cost of installation work, following increased cost of labour, will result in many potential customers withholding their orders, with consequent diminution of trade. Electrical contracting work, again, is largely seasonal, and the labour is to some extent casual—there is in normal times a large floating surplus of unemployed. The men work in small gangs, and, except in new buildings, come little into contact with other union men. The trade, as practised by the usual nondescript wireman, is not difficult to acquire, and is easily recruited.

All these facts taken together militate against a strong union: so that the electricians as a body are not, nor are likely to be, in a position to demand more than they are worth. They must be content to be subject to the practical laws of supply and demand. And on this basis, 9½d. an hour would appear to be the fair market price of the *average* wireman: that is to say, any contractor can take his pick of any number of non-unionists willing to work at that price, or even less. On the face of it, £2 2s. a week of fifty-three hours is a fair living wage for the work, neither arduous nor difficult, which the average wireman is called upon to do. Doubtless he would be well satisfied with it, if it could be depended upon all the year round. But he—the average wireman—finds his earnings considerably reduced by the fact that he may be out of a job for a fortnight, after being employed for a month. The natural result is discontent and unrest.

On the other hand, continuity of employment is an ideal difficult to realise in the contracting trade. The Union's suggestion of a fifty-hour week would go some way towards spreading labour more evenly. For that reason alone, it ought to be adopted, apart from the fact that, within limits, shorter hours mean greater efficiency. On a fifty-hour week basis the men would require 10d. an hour in order to earn the same weekly wage: and employers would be justified in granting that rate, as they would probably get as much work done for the same amount of money. No contractor needs telling that a short day's work or a short week's work will last a full day or a full week, irrespective of the precise number of hours.

But the mere raising of the minimum rate cannot provide more than a temporary palliative, for it leaves dissatisfied the better men in the trade, the men whose presumably greater energy and intelligence sway the policy of the Union. And they are restless and discontented without perhaps realising the fundamental cause: and that is, that they cannot command their true value in the labour market. They are worth more, but cannot get more, than the minimum rate. The union rules may, in theory, permit the employer to pay more if he will; but, on the other hand, all their members are "equal"—the careless clumsy worker *must* not be paid less than *may* be given to the highly skilled man. The result is that, however willing an employer may be to give one man who is worth it 11d. an hour, he cannot always afford to do so while he has to pay 9½d. to another man who is only worth 8d. an hour. Forced to overpay the one, he usually strikes an average by underpaying the other; and the man who suffers is the man who is better than his fellows. That is the result of the inherently false principle on which modern trade unionism works: essential to it, albeit opposed to common sense, for without it it could never attract and keep the membership of the men at and below the average, who together form the majority of the trade. Their interests must be secured, although at the expense of the men whose value is above the average.

Grading, then, is unlikely to find favour in the eyes of the Electrical Trades Union; but, nevertheless, grading, with judicious safeguards, is the true solution of the labour problem in trades where the work is varied and makes unequal demands on the workers' skill and stamina, as in installation work. Now is the time for that very undistinguished body, the Electrical Contractors' Association, to distinguish itself. Hitherto it has done little for its members, and less for the trade at large, with the result that many important firms are not members. It is, however, the only body sufficiently representative of the trade to be able to organise a grading scheme, such as that outlined below, which would provide a permanent solution of the present labour problem.

Strictly speaking, grading—paying men according to their value to their employer—would entail some men being paid less than the present minimum. But a minimum that will give the worker a fair living wage, irrespective of his merits, must be retained. Not only is it bad from the point of view of the community that a man should receive less than a living wage, whether he deserves it or not, but it is bad from the point of view of the employers. Without a fixed minimum, unscrupulous firms would scamp their labour as they do their material, and the more scrupulous firms would suffer. A minimum rate for labour acts, as does a specification in the case of material, in equalising competition.

For the present argument, let the minimum rate for wiremen be 10d. an hour. In view of the superior gradings hereinafter suggested, this may appear high; but with a fifty-hour week it means little more than £2 a week—surely the least that a skilled London worker, of married age, should be asked to exist upon. Besides, any scheme that involved the reduction of the weekly earnings of the majority would, whatever its compensating advantages, stand no chance of acceptance by the men.

It will be generally conceded that the *average* length of time a man retains his employment forms a rough and ready, if not the only evidential, index of his merits. It provides a convenient standard by which he can be graded. If, then, a man works 50 weeks for one firm in any consecutive 52 weeks, let him be entitled to claim an extra ½d. an hour, one year after the expiration of the qualifying period. If he were entitled to the higher rate *immediately* after

the qualifying period, a firm who did not wish to pay him the extra ½d. might be tempted to get rid of him just before he completed it, and so he would lose his benefit. They would have no such motive if there were an interval of a year before the higher rate came into operation. They might still discharge him at the end of say twenty-three months; but a month after leaving them he would get, from the next firm that took him on, the extra ½d. for which he had qualified. If he fails to command continuous employment at the higher rate—if within the year he does not stay with any one firm for, say, thirteen weeks—let him fall back, at the end of the year, to the lower grade from which he was advanced. These two simple principles, providing for promotion or relegation, would between them ensure an automatic and accurate grading of the men.

The poor worker, for instance, who is not worth 10d. an hour, will never rise above that rate—would, indeed, fall below it were it not the minimum—for he will never, except under extraordinary circumstances, be employed by any one firm long enough to qualify. Moreover, he will pay for his inefficiency, as he does now, by being only casually employed.

The marginal man, the man who is just worth 10d. an hour, may, if his employer be busy, stay with him long enough to qualify for 10½d. an hour; but when the time comes for him to be paid at that rate his employers will successively find he is not worth so much to them; and, after a year, he will sink back to his former grade, with advantage to himself. He, although paid at the same rate as the poorer worker, is rewarded for his greater efficiency by being able to command more continuous employment. These two classes of men will be no worse off than they are at present. There will be a slight advantage, in fact, to the efficient 10d. man, resulting from the fifty-hour week, and the lessened competition of the higher grade men.

Finally, the good man, who is worth more than the minimum, which is all he commands under the existing circumstances, will qualify and find employment continuously—that is, for more than three months at a time—at 10½d. an hour. Or he may qualify for a further advance, to 11d., or 11½d., or more an hour, until he reaches a rate at which he cannot secure continuous employment. He must then be content with the rate immediately below, which represents his normal grade.

It will be objected that employers would be no more willing to pay 11d. an hour to men, under such a scheme, than they are now. But the conditions would be entirely different. At present men can be got for the minimum who are worth more, but know it is useless to ask more from an employer who knows nothing about them. Few of them stay long enough in one employment to prove their worth, lacking any strong inducement. The suggested scheme would provide it; there would be less of the slackness, bad time-keeping, and irresponsibility which spoils many who have the ability, without the ambition, to become valuable workmen. There would thus be a larger number of men worth more than the minimum than there are now, and unless an employer were content to take the lower grade of men, he would have no option but to pay the higher rate. Even now, there are few firms of repute who do not pay one or two men, whose worth they know from experience, more—sometimes much more—than the minimum, in order to retain their services. If they could take on a stranger whose credentials showed him to be the particular class of man they wanted for a particular job, there would be no reason why they should demur at paying him the same as the man whose value they had proved for themselves. Moreover, if they wanted that class of man, they would have no choice. The whole scheme presupposes an organisation which would enforce the due payment of each grade on all employers and men: either the trade union, if they be willing, or a representative association of the employers, or both.

The higher grade men need not fear lack of employment. The openings for the 1s. an hour man will, of course, be rarer than for the lower grade men, just as there are fewer billets for engineers at £1,000 a year than at £100. But any sane contractor would rather pay 11d. an hour to a man who does elevenpence-worth of work an hour, than 10d. an hour to the man who does tenpence-worth. For the extra penny an hour represents more than the value of work done. It stands for freedom from petty worries, increased confidence, and saving of supervision, and, ultimately, enhanced reputation. Tne better class of employers would employ higher grade labour as they use C.M.A. cable, or seamless tubing. It is reasonable to suppose that consultants would specify that certain jobs should be done by a certain grade of labour. Indeed, it is possible that in this way there would be built up a demand for higher grade labour which would outstrip the supply, were it not that some of the marginal men would thus be enabled to qualify for a grade higher than that which their intrinsic merits would enable them to attain.

There would be no extra money as now, for charge-hands. What would amount to the same thing would be a regulation to the effect that only higher grade men could be charge-hands. For instance, while a wireman at 10d. could work on a small job with a mate, a gang of four would have to include a charge-hand at 10½d., and one of eight or more, a foreman at 11d. an hour. This regulation alone, apart from any other consideration, would ensure adequate employment for the higher grade men. Needless to say, when, as suggested above, a specification called for all the wiremen to be, say, 10½d. men, the charge-hand, or foreman, would have to be a relatively higher grade man.

The case of the man who wanted to remain with a firm who were equally desirous of keeping him has to be considered. According to this scheme, they would have to give him a rise of ½d. an hour every two years, and it is obvious that, in time, the rate per hour would become prohibitive; and the man would have to go, however much he might prefer safe permanent employment with the one firm to the risks of intermittent employment at higher rates. In his interests, therefore, some rule would be desirable to the effect that no firm should be obliged to give more than two rises to the same workman remaining continuously in their employment. After a further two years, he would have the option of remaining with the same firm at the same rate, or of leaving them, qualified for the next higher grade. There would be nothing, of course, to prevent an employer giving a further increase by mutual agreement.

The question of mates is not an easy one. At present, as far as one can gather, a mate may dub himself a wireman as soon as he has acquired a sufficiency of self-confidence and a kit of tools. Many never become, nor are fitted to become, fully qualified electricians. Those who have the capacity should be assisted in every way; but any rigorous system of qualification by length of employment would make promotion an impossibility for them. Mates cannot, as a rule, keep their jobs as long as wiremen. Their conditions of labour are more casual. Their retention or dismissal depends largely on the wireman whom they are mating, and the employer rarely has an opportunity of discovering their merits at first hand. He makes no special effort to retain their services, knowing that he can get others at an hour's notice, equally suitable for his purpose. For the same reason, mates who demand more than the minimum would, under present conditions, find it hard to get employment at all.

(To be concluded.)

THE "CASCADE" INDUCTION MOTOR.

By L. J. HUNT, M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *at Leeds, February 11th*, 1914.)

IN 1907 the author read a paper on this subject before the Manchester Local Section of this Institution when the motor was in its early stages of development. Since that time large numbers of these machines have been built and numerous new windings have been worked out and tried, with the result that the modern machines differ materially from those described in the paper to which reference has been made.

The "Cascade" idea has been used for many years in the control of three-phase locomotives, for obtaining several speeds in rolling-mill work, and for the driving of fans, &c. It is almost exactly analogous to the coupling of two or more motors in series on a continuous-current circuit. If two similar continuous-current motors be connected in series, with their shafts mechanically coupled, the speed of the combination will be half that of either motor directly connected to the line. Next consider one of the motors wound for a speed of 1,500 R.P.M., and the other for 750 R.P.M., with the two machines in series. As the torque is proportional to the back electromotive force and the current in the armature, it follows that the low-speed motor will develop two-thirds, and the high-speed motor one-third of the total torque developed by the combination. It will be obvious that for any given speed the back electromotive force generated by the low-speed motor will be equal to twice that generated by the high-speed motor, and therefore the back electromotive force of the two machines in series will be equal to three times that generated by the high-speed motor alone. The set will therefore run at one-third the speed of the 1,500-R.P.M. machine, or two-thirds of that of the 750-R.P.M. motor, *i.e.*, 500 R.P.M.

In the case of two induction motors wound for speeds of 1,500 and 750 R.P.M. the speed of the two coupled in series or "Cascade" will similarly be 500 R.P.M. In this case the secondary of the first machine is connected in series with the primary of the second machine, and, therefore, as the same currents circulate in both, the frequency must be the same. As in the case of the continuous-current machines, the low-speed motor will develop two-thirds of the total torque. In an actual case the pressure-drop due to resistance in the first motor slightly affects the relationship. If the rotor of the first machine is connected to the stator of the second machine, the windings must produce a flux in both stators revolving in the direction of the mechanical rotation. At 500 R.P.M. the slip of the first motor will be 250 R.P.M. if the low-speed motor is connected to the mains. This motor will have eight poles if wound for a 50-cycle circuit. The second motor will have four poles, and consequently the speed of the stator field will be equal to twice the speed of the slip of the first motor, or 500 R.P.M. It follows that the frequency of the currents in the second rotor will be zero—the condition for synchronous speed.

The speed of the combination is equal to that of a motor wound for the sum of the numbers of poles of the two machines.

At the synchronous speed of an induction motor no energy is transmitted to the rotor, and if we assume that the distribution of flux follows a sine law there will be no current in the secondary windings. If, then, the mains are connected to the rotor of a machine the latter will revolve in a direction opposite to that of its magnetic field, so that at synchronous speed the field will be stationary in space and no electromotive force will be generated in the stator windings which now form the secondary of the motor. Instead of connecting the rotor windings of the first motor to the stator windings of the second machine we may connect them to the second rotor windings, taking care to reverse two of the connections so that with currents circulating in both windings, the magnetic fields produced will rotate in opposite directions. The stator winding of the second motor now becomes the secondary, and the rotor windings may be permanently connected without slip-rings. Control of the speed and starting torque is obtained by connecting resistances to the stator windings of the second machine. Here, then, we have a combination of two motors forming a single unit with their rotor windings permanently connected, and as no currents are brought out from the rotors the windings may consist of several parallel circuits, so that the voltages in them will be quite low even when the rotors are standing. This construction meets the requirements of a machine with a rotor winding approximating to that of a squirrel-cage machine, and with the same facilities for control of the starting torque and speed that can be obtained with a machine with wound rotor and slip-rings. We have, however, sacrificed much in obtaining these results. The necessity of using two machines leads to a greatly increased cost; and, further, the efficiency and power factor will be low, so that the construction is of little practical value. It was, however, the fundamental idea from which the motors described in this paper were developed, and will serve as a key to the explanation of their windings and properties.

There are examples of "cascade" coupling in nearly every power plant in the country. We install a step-up transformer and then a step-down transformer in a sub station; these are coupled in cascade and exactly represent a cascade motor at standstill. The energy current taken from the mains by the first transformer is dependent on the resistance (or load) connected to the secondary windings of the second transformer, and the first transformer takes from the line not only its own magnetising current but also that required by the second transformer. In fact the calculations necessary for determining the currents in the windings, the power factor, &c., are identical in both cases.

The next step in the development of the motor was to make a single stator and rotor which would take the place of the two separate machines. The problem to be solved was so to arrange the two sets of windings that there should be no mutual interaction, electrically or magnetically, between them, except by the agency of the interconnected rotor windings.

The first motor built at Sandycroft in 1905 showed that it was possible to construct a single cascade motor; but it was at once apparent that the electrical properties were inherently bad. Electrically and magnetically the motor described later is identical with this machine, but new types of windings are used in it which overcome the bad features of the original design.

The cascade motor is essentially a low-speed machine; and it is when designed for speeds which are abnormal for single-field motors that it shows to best advantage. The number of poles for which the machine can be constructed are determined by the following conditions:—

(*a*) The number of poles in the two fields must be so chosen that their windings are mutually non-inductive.

(*b*) The two fields when superimposed must not produce an unbalanced radial pull on the rotor.

Condition (*a*) is satisfied when the two numbers of poles are such that when divided by their "greatest common factor" the quotient is in one case an even and in the other case an odd number.

To satisfy condition (*b*) the two superimposed fields must give a symmetrical resultant field; the "greatest common factor" must be a number greater than two. The most usual numbers of poles are in the ratio of 2 : 1.

If was evident that to make the machine commercially successful a way had to be found to obviate the necessity for two separate sets of windings. What was required was a single winding suitable for two entirely independent currents, one at line frequency and the other at the frequency of slip. This was a stator problem; the treatment of the rotor windings, requiring a different solution, was left till a later date. The required winding had not only to be suitable for the circulation of these two independent sets of currents, but had to be so connected that the induced or low-frequency currents could only circulate when paths outside the windings were provided for them. This was necessary in order that the starting torque and speed could be controlled by causing the induced currents to flow through variable external starting or regulating resistances. Two sets of terminals were therefore required, one set for connecting to the mains and the other set to the resistances. The main currents must not be allowed to flow through the external secondary paths, and consequently it was essential that any one pair of secondary terminals

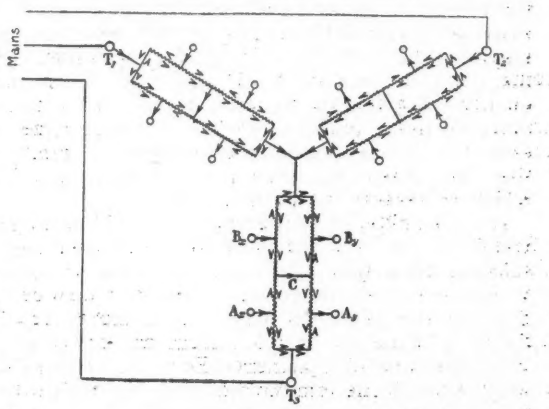


FIG. 1.

should be connected to two points in the windings between which there existed no "main" potential difference. To meet these conditions a parallel-connected winding was necessary. Fig. 1 shows a suitable form of winding. The main terminals are lettered "T," and the six pairs of tappings are those to which separate sets of resistances would be connected for starting and speed-regulating purposes. When running at full speed each pair of tappings would be short-circuited. Arrow-heads shown inside the diagram indicate the direction of flow of the main currents at a given instant; those outside the diagram similarly show the direction of flow of the induced currents.

Fig. 2 shows an eight-pole winding which could be connected up in accordance with it.

The application of this winding to machines having a larger number of poles introduces no difficulties. The effective value of the ampere-bars is 70·7 per cent. of the total ampere-bars, compared with the two separate windings of the original machine, the whole of the copper being merged into one winding gives a greatly reduced effective value to the resistance, so that for a given weight of stator copper the I^2R loss is reduced to rather less than one-half.

Having obtained the required stator winding, attention was next paid to the rotor. As both windings carry currents of the same frequency and no external connections are required, the treatment is quite different from that applied in the case of the

stator. As there are only two axes of coincidence in a motor having four and two poles, such a machine is not practicable, as the shaft would be subjected to unbalanced radial forces. It will, however, save needless repetition if we work out the rotor windings for this number of poles.

In practice the best results have been obtained with rotors having main and auxiliary windings in the ratio of 1·73 to 1·0.

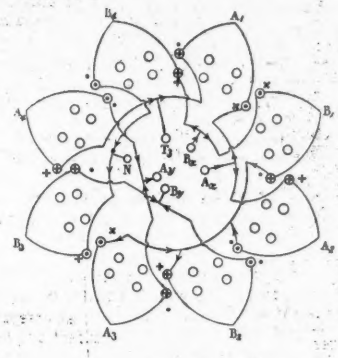


FIG. 2.

This ratio gives an auxiliary field with a flux per pole 73 per cent. greater than the main flux, and an average figure for the reactance of the auxiliary windings is 40 per cent. of that of the main windings.

Fig. 3 shows a developed diagram of a four-pole winding. The slot pitch has been shortened to two-thirds the normal, so that

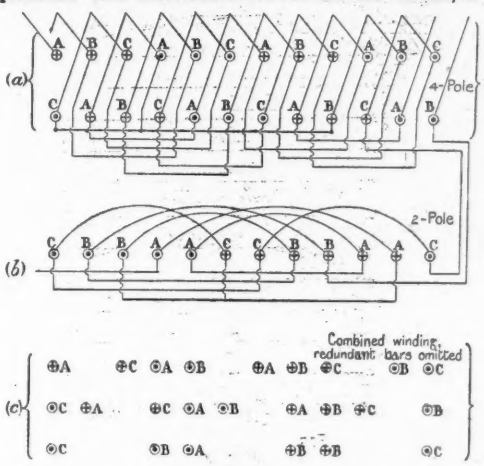


FIG. 3.

bars carrying currents differing in phase by 60° occupy the same slot. In the same slots is shown a two-pole winding of full pitch with 1 bar per slot. The two windings are interconnected so that the same current circulates in each; consequently with 1 ampere per bar there are 1·73 ampere-bars in the four-pole winding and 1·0 ampere-bar in the two-pole winding.

In this diagram as well as in all the others in the paper instantaneous values of the currents are taken at the instant when the current in B is 1·0, and those in A and C 0·5 each.

From an examination of the winding it will be seen that in slots 2 and 3 there are two bars carrying currents of the B phase which are equal and opposite. In slots 6 and 7 the bars carry equal and opposite currents of the C phase, and the same conditions are found with currents of A phase in slots 10 and 11. It is clear that two conductors carrying equal and opposite currents in the same slot can produce no useful magnetomotive force. We therefore omit these bars. There are now left six slots each containing only one bar, as shown in the figure below the original four-pole and two-pole windings. In each of the slots containing three bars, two of the bars carry currents of the same phase, and the current in the third bar differs in phase from the others by 60°.

If a conductor carries two currents of the same amplitude differing in phase by 60°, the crest value of the resultant current equals 1·73 times the crest value of either of the component currents, and the phase of the resultant current lies midway between the phases of these component currents. This phase relationship is found in an interconnected star and mesh winding.

By connecting up the combination winding, fig. 3, to form a star and mesh construction we can use two bars per slot instead of three, and thus simplify the winding. It is only necessary to merge two bars carrying currents differing in phase by 60° and call all such bars star bars. All that is required to complete the winding is to provide suitable end connections to give a star-mesh construction. This has been done in fig. 4. The combination winding will require 7·8 per cent. more copper than the original four-pole winding.

The arrangement of the end connections was changed and a barrel type of winding of the usual type was developed. This is shown diagrammatically in fig. 5. The slot pitch of all the coils is the same and the end connections can be supported on rings in the usual manner and held in position by binding wire. A rotor with this winding resembles an ordinary rotor except that one-quarter of the bars have been omitted.

The back electromotive forces induced by the two-pole field are equal and opposite to those induced in the winding by the four-pole field. The voltages taken round the mesh are in balance. No currents can therefore circulate except by way of the star windings. There are then only three circuits, and the back electromotive forces in each circuit are equal and opposite to the electromotive forces induced by the main field.

This completes the description of the cascade machine in its simplest form. In another section of the paper, motors with two or more efficient speeds are described, but in these the extra speeds are not obtained by cascade coupling. The windings already described are used in all the machines, and only certain additions are made to the rotor to enable it to operate at non-cascade speeds.

The completed motor closely resembles a machine of ordinary construction. The stator windings are identical in appearance, and only differ in the cross-connections of the coils. Standard construction is also used for the rotor. The efficiency and power factor curves of a 330-B.H.P., 50-cycle, 200-R.P.M. motor having 20 main and 10 auxiliary poles are shown in fig. 6. The gap diameter of the motor is 56 in. The stator slots are of the completely open type, and those of the rotor are semi-closed.

The cascade machine has a very small slip, because the resistance of the rotor does not directly affect it.

The core of a cascade machine has to carry both the main and auxiliary fluxes, but as the secondary flux is only rotating at the speed of slip, the loss due to it is small and the flux density behind

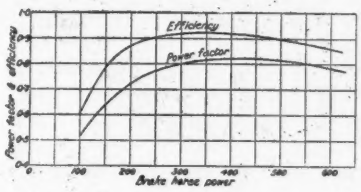


FIG. 6.

the teeth can be raised to a high figure. The density in the teeth must, however, be kept within reasonable limits, otherwise the power factor may be considerably reduced. The actual iron loss in a motor of standard design is practically unaffected by the presence of the auxiliary field.

The presence of the auxiliary field has a marked effect upon the behaviour of the motor when starting and "creeping." It gives the machine a more even turning moment; the motors will run quite steadily with resistances connected to the stator tappings, at less than 1 per cent. of their full speed, and at starting they develop a very steady pull. For these reasons the machines have been extensively used in the driving of all classes of hauling machinery, and they give satisfactory inching in the driving of printing presses and similar machines.

Owing to the very low-voltage windings used in the rotors and the absence of slip-rings, single-speed motors are found to be very successful in the driving of all classes of mining, cement and quarry machinery, and they are now being introduced into rolling mills.

Machines of this type develop full-load starting torque with approximately full-load current, and they can be designed to suit all conditions of starting. The standard design of motor starts against any load up to 2 to 2¼ times the full-load torque, and regulation of the starting torque is obtained by varying the resistances connected across the stator tappings. At full speed these tappings are short-circuited in the same way that the rings are short-circuited in motors of the usual slip-ring type.

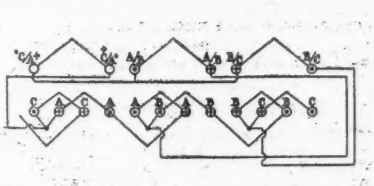


FIG. 4.

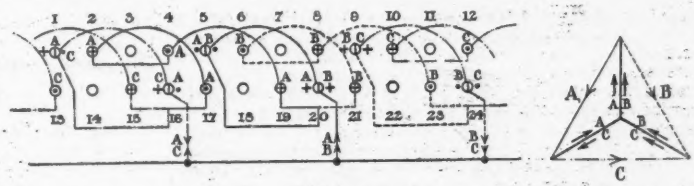


FIG. 5.

Unless the machines are required to run at reduced speeds for a considerable time it is unnecessary to provide resistances for all the stator tappings. Tests made some time ago showed that with resistances connected to two pairs of tappings in one leg of the winding the motor would start against a torque equal to a little more than full-load. With three resistances, one in each leg of the star, the motor starts against a torque approximately equal to its maximum running torque. In the usual way either three or four resistances are used at starting and for moderate speed regulation, and the remaining tappings are short-circuited when the machine has attained full speed.

If an ordinary slip-ring rotor wound for the same number of poles as the stator be substituted for the cascade rotor the machine will run as an ordinary one-field motor. The machine will run 50 per cent. faster than with its own rotor, and will possess the actual characteristics of a motor of standard design.

In the first two-speed motors two windings were used on the rotors, one wound for the same number of poles as the main flux and connected in star, and the other wound for half the number of poles and connected in mesh. From the points of inter-connection of the two windings leads were taken to three slip-rings. When the motor was required to run at cascade speed the slip-rings were open-circuited and the machine was started by resistances connected to the tappings. When required to run at non-cascade speed, the tappings were open-circuited and the motor was started by means of resistances connected to the slip-rings in the usual manner. When running at top speed the short-circuited slip-rings prevented any appreciable current from flowing into the second rotor winding. This type of winding required very deep motor slots in order to keep the losses down, and this made it very difficult to get enough iron into the teeth to prevent over-saturation.

We have already noted that the cascade rotor winding is non-uniformly distributed. If the winding can be made uniform when desired, the second field can be suppressed and non-cascade speed obtained. To do this it is necessary that all slots should carry the same number of bars. All that is necessary is to take the "cascade" winding, fig. 5, insert the three coils which were omitted, and connect one end of each to a slip-ring and the other ends to the middle points of the delta parts of the winding. The winding thus produced is shown in key diagram in fig. 7A. The three slip-

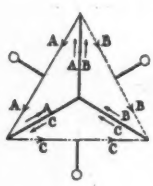


Fig. 7A.

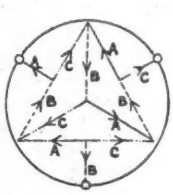


Fig. 7B.

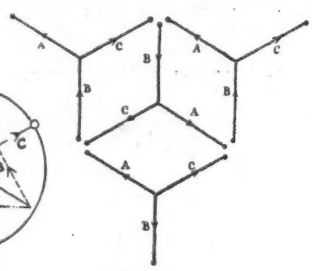


Fig. 8.

rings are open-circuited and the currents shown correspond with those in fig. 5 for cascade working. When the three slip-rings are short-circuited, as in fig. 7B, at each point where three bars meet, the B current divides into A and C currents, so that each point is in reality a neutral point, and there are 8 such points in the winding, which is equivalent to four interconnected star windings, fig. 8. The currents must necessarily all have the same amplitude and they will all be controlled by an ordinary three-branched resistance connected to the slip-rings.

The weight of copper in this type of rotor winding is less than one-half of that in the original double windings; and as quite shallow slots will accommodate it, the reactance is naturally very much less. The construction of the winding follows standard lines for barrel-type rotors, and any rotor with this type of winding can be made to give the extra cascade speed by changing its cross connections.

A motor of this type is designed in exactly the same way as a machine of the ordinary type wound for the main number of poles.

The pull-out torque of the two-speed motor is approximately the same at both the speeds, and the no-load current at cascade speed exceeds that at non-cascade speed by 75 per cent. When a motor is required to drive a fan or any machine which requires less torque at its second speed than at full speed, a star-mesh switch is mounted on the motor so that the machine may be run with its stator windings connected in mesh at full speed and in star at cascade speed. This arrangement reduces the no-load current at cascade speed to one-third of its usual value, or 58 per cent. of the full-speed current. The overload capacity is similarly reduced, but is ample for a fan driven at two-thirds its normal speed. The arrangement brings the cascade power factor well up on the curve and also permits of the use of a smaller motor, because the machine at cascade speed is operated with a main flux reduced to only 58 per cent. of its value at full speed. The machine can therefore be designed for standard densities at full speed.

The curves in fig. 9 are those of a two-speed motor driving a colliery fan. The machine gives 120 B.H.P. at 580 R.P.M. and 30 B H.P. at 397 R.P.M. on a 40-cycle circuit, and is wound for 2,750 volts. It operates at eight-pole and 12-pole speeds, but as deeper slots than the standard were required to take the high-tension windings the power factor at the second speed is a good deal below the figure for low-voltage machines. Any speeds between the limits of 397 R.P.M. and 580 R.P.M. are obtained by resistances connected to the slip-rings, and speeds below 397 R.P.M. by resistances connected to the stator tappings.

In the majority of cases speeds below cascade are not required and the control of the machine can then be considerably simplified.

For operating foundry cranes the single-speed machine is generally used on account of its inching qualities; but two-speed motors are used for the longitudinal motion of travelling cranes in long shops. When travelling with a load the machine runs at the second speed, and the high speed is only used when the crane is travelling light. The controller, which is generally of the tramway type, is provided with three extra contacts with an extra high-speed notch. When the motor is required to run at top speed the controller handle is brought over to the extra notch, in which position the stator tappings are opened and the slip-rings are short-circuited. This arrangement is very simple and has proved entirely satisfactory.

The application of these motors to the driving of winding engines and rolling mills is a development of recent date. Two winders have been put into commission in South Africa during the last few months.

The cascade system offers the advantage of gradual change from cascade to full-speed coupling with the motor connected during the whole time to the line. The stator is never disconnected from the mains until the brakes have been applied and the motor has been brought to rest. There is no fierceness in the control at creeping speed and when starting; consequently decking is under complete control.

Machines wound for speed ratios of 3 : 1 are used where a large difference between the two efficient speeds is required, or where regeneration down to low speeds is desired. This occurs in connection with electric winders and electric lift work.

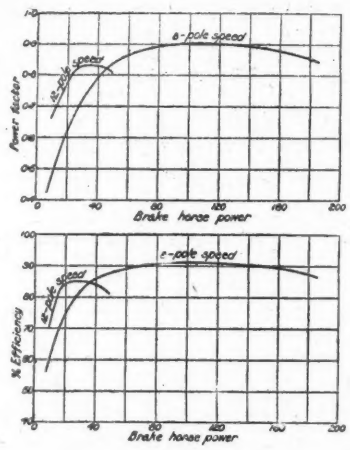


Fig. 9.

The two-speed motor can be operated at a third speed if the stator windings be so arranged that they can produce two different numbers of main poles. For example, a two-speed motor wound for eight main and four auxiliary poles, and running at 750 or 500 R.P.M. on a 50-cycle circuit, can be made to run at a third speed of 1,500 R.P.M. by changing the stator winding in such a way that the line currents will produce a four-pole field.

Particulars of two three-speed machines may be of interest; the first was built to the specification of Mr. G. H. T. Hooghwinkel, and drives an air compressor at a colliery in South Wales. It gives 400, 200 and 133 B H.P. at speeds of 300, 150 and 100 R P.M. on a 25-cycle 2,200-volt circuit. It is wound for 10, 20 and (20 + 10) poles.

The second machine gives an output of 300, 150 and 100 H.P. at speeds of 300, 150 and 100 R.P.M. on a 25-cycle 440-volt circuit. This machine also drives an air compressor used for refrigerating purposes.

This concludes the description of the machine as it stands at the present time. It would be futile to say that its development is complete, for cascade operation is full of possibilities.

Discussion at Leeds.

Dr. Pohl congratulated Mr. Hunt on his success in having developed the cascade motor from a purely theoretical idea into a practical motor, in regard to which he considered that the engineering world owed the author a debt of gratitude. The advantage of Mr. Hunt's motor was that the rotor had no slip-rings, and, therefore, some people believed that it was the equivalent of a squirrel-cage motor. The cascade motor, however, was something quite different from the squirrel-cage motor, which was the most reliable type of machine, because it was practically invulnerable. The cascade motor relied upon the safety of the insulation, and it seemed to him that if they got such a breakdown of the insulation in the rotor that it failed to superimpose the four-pole field, the rotor would run up to the speed of the eight-pole rotor. The actual winding, which consisted of two circuits connected together, was rather a complicated affair, and altogether different from the squirrel-cage motor. In the high-tension stator winding they

already had a fairly thin wire, and yet it was proposed to split that into two wires, which he did not think was an improvement at all. Also, there were a considerable number of extra connections, which increased the danger of a breakdown. He preferred the ordinary series winding, because it had fewer connections. He would expect a great disadvantage also with regard to the power factor, in consequence of the long connections of the coils and the longer projections from the stator iron. In the case of variable-speed motors the cascade had a useful application, but the steps in the speed were very great. They could not get any steps between 500 and 750 R.P.M. on the 50-cycle circuit, which was very unfortunate because that was the most useful range of speed variation. When they had to deal with the problem of driving a fan at two distinct speeds the best engineering solution was not what Mr. Hunt had done, but to use an ordinary 120-H.P. motor for one speed, and put on the same shafting a common squirrel-cage motor running at the other speed. He was always in favour of using the simplest type of machine whenever it was possible, and there was no objection to using the ordinary squirrel-cage motor up to 80 or 100 H.P. on the large A.C. mains. He suggested to Mr. Hunt that useful as the cascade motor was in some ways, it was a kind of blind alley development, and not in the line of true progress. What was coming, he thought, was the variable-speed three-phase motor, the speed of which could be varied within very wide limits without definite steps. The repulsion and commutator motors were constantly being improved upon, and they would ultimately reach the variable-speed repulsion motor.

Mr. Wilson Hartnell said he also, if he wanted to run a fan at two speeds, would put down a motor for the full speed, and another simple short-circuited motor for the other speed. He could not help thinking that a commutator motor of some kind would get over the difficulties that Mr. Hunt had in mind. Modern thought in connection with engineering was all in favour of simplicity.

Mr. H. H. Wright said he thought that the cascade motor could be profitably used in the case of the Lacour motor converters, and in winding engines and haulages, and asked if Mr. Hunt had ever proposed to apply it to the propulsion of ships.

Mr. Creedy said that though they could all see the complexity of the theory of the cascade motor, the machine as practically built was the very reverse of complex. He had seen it both in the factory and in use, and it seemed to him to be superior in robustness to the ordinary induction motor. He wondered whether there had ever been carried out an internal cascade commutator machine having the gradual variable speed, which was so desirable in many cases, combined with the properties of the Hunt motor. The complexity which appeared in the cascade motor which had been described arose in grasping the method and its operation, and this did not affect the working in the least. He thought the two principles of speed variation should co-operate. Neither was likely to supersede the other, but both were likely to be used side by side, both independently and in combination.

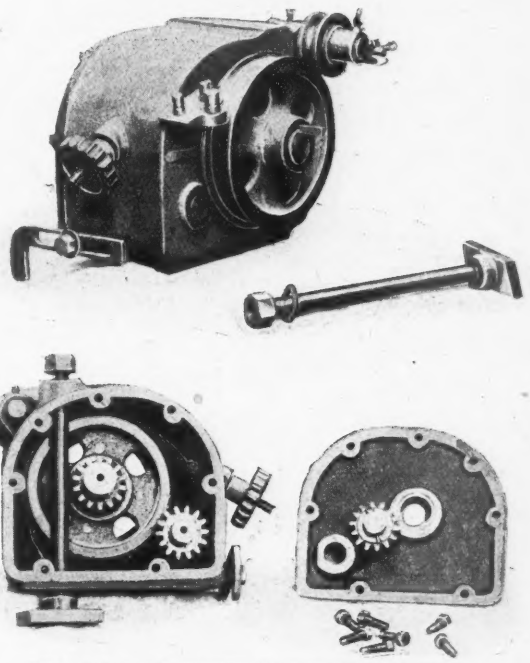
Mr. Burnand said that he did not know whether the cascade motor had any advantage over the ordinary pole-changing arrangements as described by Nicholson and Haigh last year. He had been struck by the similarity in principles that they kept finding in widely-varying applications. The cascade arrangement appeared to be practically the same as one that they came across in certain provisions for high-frequency current in connection with wireless telegraphy. Fig. 1 was practically the phantom circuit arrangement used in telegraphy, where they got two circuits acting as three as the result of one acting upon the other. The craving for simplicity could be carried too far, and he thought the cascade motor had a niche of its own to fill. The complication was more imaginary than real.

Mr. Hunt, in replying, said Dr. Pohl's criticism brought the question down really to a matter of squirrel-cage machine *versus* cascade machine. He had never attempted to say that the cascade machine was the best possible under all conditions. It had a special field under conditions where the slip-ring motor might give a considerable amount of trouble, especially in quarries and mines, where it was constantly replacing motors of the slip-ring type. The squirrel-cage motor had an ideal construction. They could not have anything simpler, but it was an absolute fallacy to push it in large sizes and where they had to start against considerable torques. Many used under such conditions had had to be pulled out and slip-ring motors put in their places. As to the safety of the insulation, there was a large number of parallel circuits in the motor, so that they always had a very low voltage. He had never known a case of the motor running up to non-cascade speed; in actual operation it was an utter impossibility for the machine to attain a high speed. These motors had been wound up to 3,000 volts, and there had been no difficulties at all. It was found in actual practice that the machine would operate with the rotor very badly out of the centre, owing to the parallel windings, because it was capable of balancing the effects of the uneven wear. The power factor of the cascade motor was up to the average, and in some cases it was above the power factor of other motors of the same H.P. As to the two-speed motor for fan driving, the position was that at one speed it was connected in mesh, and in the other in star, so that it was possible to take a standard 120-H.P. motor and turn it into a fan motor, and change the connections, so that they did not lose any advantage with the two-speed motor, except that there was the little extra expense of the winding. Of course, the ratios in the speeds were fixed. The cascade motors had been very largely put in for driving fans. The cascade machines were actually cheaper to make than the ordinary machines, because there was very little copper in them. Mr. Creedy's idea of an internal-cascaded commutator was a very fascinating one.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

A Special Tool for Armature Banding.

The illustrations show a special equipment for armature banding, which, although capable of use in connection with any method of rotating an armature which has to be banded, is primarily designed to be used directly on a lathe taking the place of the tool post. It has been made by the United Engine and Manufacturing Co., of Hanover, Pa., and fig. 1 shows its external appearance completely assembled, fig. 2 indicating the interior construction of the mechanism. It will be seen that it consists of a main drum round which the banding wire passes, being guided to it by the three studs shown in fig. 1, immediately behind the drum. It then passes over a grooved pulley shown, to the armature which has to be banded. The large drum is subject to a retarding force inside the case, which is given as shown in fig. 2, by means of a metal strap covered on the inside with leather, the tension of which can be adjusted by means of a knurled-headed screw. The brake drum and the external wire drum are free to rotate with respect to one another, but inside the case is a reduction spur gearing, by means of which a magnification of the effect of tension exerted by the internal strap is obtained on the external brake drum. In this way a very strong retarding force is obtained. The complete tool is mounted on the lathe carriage by means of the removable rod shown in fig. 1, lying at the side of the tool, and in fig. 2 placed in position. Clamping arrangements are also provided for holding the band wire tight when the banding is finished until the armature banding operation has been completed and the wire can be severed.



Figs. 1 & 2.—Armature Banding Equipment.

A Simplex Interior Fitting.

Messrs. Simplex Conduits, Ltd., of 116, Charing Cross Road, W.C., send us supplementary sheet T6, dealing with their well-known conduit system of electric wiring particularly adapted for use in factories, warehouses, &c., where girders are encountered. Amongst the items illustrated and described may be mentioned an

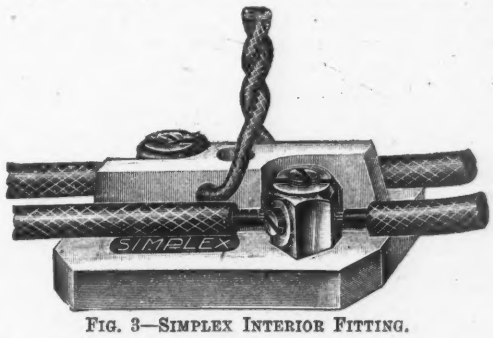


Fig. 3—Simplex Interior Fitting.

interlocking switch plug, watertight switch, girder clips for right angle and parallel runs of conduit, spacing saddles, &c., and an improved type porcelain interior, which we illustrate in fig. 3, and which is intended for use with standard types of rectangular junction boxes as a means of taking tappings off the main circuit wires or for connecting a flexible wire to a lighting point. The interior is double pole, and has two main terminals of unique design. These terminals are hexagonal in shape, and have a central slot, which slot is threaded internally to take a grub screw. The particular advantage of this type is that it is not necessary to actually sever the conductor to secure efficient connection. The insulation is bared back for the space of about ½ in., and the exposed conductor dropped into the slot and secured by the grub screw referred to. These terminals are of sufficient size to allow of a small cheese head screw being tapped into the side for connecting the branch wires. Copies of this leaflet can be had on application to any of the company's branches.

Half-watt Lamp Fittings.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, send us particulars of some new lanterns for half-watt lamps, which are specially adaptable to interior and exterior shop lighting. In designing these lanterns a special point has been made of ensuring an efficient system of ventilation, whilst they are also provided with an adjustable carrier to regulate the position of the lamp in the lantern. They are made of black, vitreous enamelled iron, and provided with an insulated shackle suspension.

Fig. 4.—Exterior Fitting.

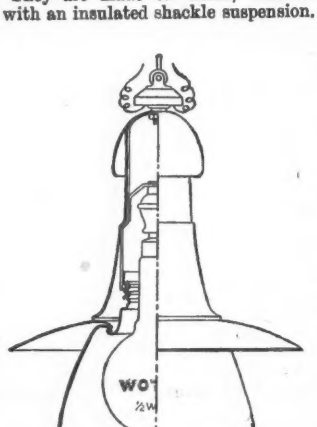


Fig. 5.—Interior Fitting.

One of these lanterns has a metal reflector of parabolic pattern, and is intended for the exterior illumination of shop windows; it will be seen that a maximum illumination is focussed in one direction, whilst the source of light is well screened from the eye on the opposite side.

The other lantern is fitted with a distributive type of metal reflector and an opalescent globe, which is open at the bottom; the effect is a soft diffusion of light without diminishing the floor illumination—at the same time being open at the bottom it aids the effective ventilation of the lantern.

The size of lantern for use with a 1,000-c.p. half-watt lamp is 19 in. × 14 in. A price list embodying these designs will shortly be issued.

BRITISH PRACTICE IN THE CONSTRUCTION OF HIGH-TENSION OVERHEAD TRANSMISSION LINES.

(*For abstract of paper read by* Mr. B. Welbourn *before the* Institution of Electrical Engineers, *see* Electrical Review, *pp.* 114, 127 *and* 202.)

Discussion at Edinburgh.

Mr. MacLeod (Glasgow) said that the delay in getting an overhead line approved was a most serious handicap to power development. In his opinion the Board of Trade and the Postmaster-General's requirements could quite well be met by the issue of suitable regulations framed on similar lines to those recently issued by the Home Office, specifying the requirements of the two departments. Detailed constructional plans, approved and certified, might be held as evidence of their consent, and as such could be submitted to the local authority; such plans could be approved for a period of five years, unless revoked earlier. It seemed unnecessary that the same formality should require to be gone through for every new line. It was particularly gratifying to note the remarks by Mr. A. P. Trotter in favour of carrying overhead lines alongside public highways. These remarks augured well for relaxing the stringency of the Board of Trade Regulations governing the angle at which a public highway might be crossed. In some cases it was necessary to use underground cable for road crossings on account of its being impracticable to meet the conditions for an overhead crossing. The success of an overhead line depended almost as much upon its position as upon its construction, and due allowance must be made for the fact that in the United Kingdom the prevailing wind in stormy weather was south-westerly in direction. If through ignorance or neglect of this fact an engineer built a line immediately to the northward of a tree or plantation, when a gale come along, small branches were detached from the swaying trees and carried bodily sometimes 15 or 20 yards, and deposited across two or more of the conductors. This factor was so important that it ought to be laid down as a standing regulation that no high-tension line should be carried past the north side of a tree or plantation at a less distance from it than 40 yards. The split conductor system as applied to overhead construction had very little to commend it, for the reason that for a given total sectional area of line, one must of necessity use double the number of insulators that would be required if only one circuit were employed, thus doubling the risk of failure. For three-phase overhead construction he was of opinion that a single set of conductors with Merz-Price balanced protective gear, employing bare pilot wires, was hard to beat. It seemed to him to be inherently bad practice to attempt to carry more than one circuit on any given pole line on account of the great risk of fatal accidents. Celluloid envelopes for attachment to the top of insulators were used very much all over the Continent. In practice it was a matter of great difficulty, without some such device, to locate punctured insulators. As soon as the line went to earth the celluloid cap was burned up. For a while the Clyde Valley Power Co. were very much troubled with punctured insulators, and at first were inclined to blame the make of the insulators, but they found by careful observation that the cause was unequal expansion in the insulator itself. After a spell of warm weather, when the long steel arms were baking in the sunshine of a warm day, it was found that the heat was conducted from the arms to the steel pins, which were maintained at a high temperature. When the cool breeze came along internal pressure was set up, and it was only a question of time before fissures began to develop in the internal structure, and led to a failure. They had had as many as six punctured insulators in a stretch of a mile. The terminal pole arrangement shown seemed to be liable to disturbance from birds settling on or about the choke coils. On the lines he was responsible for, the bird trouble had been effectually overcome by the use of treble insulation on all terminal and turning poles.

Mr. Seddon said that if they were to realise the scheme for utilising the series of locks from Fort William to Fort Augustus they would have a transmission system to rival those of their Continental friends. In comparing the relative costs of the two systems the author had been too conservative in calculating the price of cables. When a new road was started there was a temptation to lay down more copper than was wanted in the immediate future. The money spent thus would be outlying capital for many years, though it might be found a good enough investment if the business had a great and rapid extension. He asked if concrete poles were unsuitable and what objections there were to earthing one phase of the line. It seemed to him that this would considerably cheapen the structure, as only two insulated wires would be required and the line would then take the place of the earth wire. Arrester horns were likely to gather dust inside, and he found that charging the horns every day for dislodging the dust obviated hand-cleaning.

The Chairman asked—in connection with the tables on the cost of overhead in comparison with underground cables—how the latter cable was laid, directly in the ground or in troughing. That had an important bearing on the cost of the work. He had some time ago to make an estimate comparing the cost of an underground cable with overhead construction for a distance of over three miles, with a particular size of conductor, working at 10,000 volts, and the cost of the cable laid in the ground was £1,250, but the cost for the overhead line was only £620, being much less than Mr. Welbourn's estimate. In this particular case there was no question of paying for wayleaves. He thought Mr. Welbourn had capitalised the annual value of the wayleave rental. While they would like to get some standard system for overhead construction which all would approve of, it was difficult to see how that could be done, in view of the rapid development in the contrivance and also in the construction of these lines. Regarding the non-accumulation of snow on overhead aluminium wires when these were kept alive, he heard it suggested the other day that the fact that oxide of aluminium was a non-conductor of electricity might have something to do with it.

Mr. Welbourn, in reply, said the figures referred to by the chairman were necessarily representative of the general case. They were taken from actual existing contracts which represented average conditions. In this particular case the overhead line price included the price of wayleaves, and it was perhaps higher than in the case cited by the chairman, because lead-covered cables were included. The Canadian engineers were emphatic that aluminium did not gather snow, while he knew an aluminium line in this country which collected sleet and snow. It was an electrostatic effect. As to getting rules from the Board of Trade to cover lines for five years, he thought it would be rather unwise, in view of the number of changes taking place, to tie one's hands for five years. In five years they had got away from those frightful contraptions the Board of Trade required, and in five years more they might get away from guard wires altogether. In connection with reinforced concrete poles, so far as he knew these had not been used on high-tension, but he knew of two on low-tension systems.

One of these was in a chemical works where neither wood nor steel would stand, owing to the gases, but the results had not been good. The concrete had started to peel, and water had run down the poles, and they looked very bad indeed. He thought objections would be raised by the post office and railway companies to the earthing of one phase of a three-phase system.

LEGAL.

Marconi *v.* Helsby Wireless Telegraph Co.

This case was mentioned to Mr. Justice Joyce on Monday, upon an application by the defendants that it should be heard with an assessor.

Mr. Terrell, for the defendants, said the application was made under Sec. 31 Sub-Sec. 1 of the Patents Act, 1907, which provided that "In an action or proceedings for infringement or rectification of a patent the Court may if it think fit and shall at the request of either of the parties call in the aid of an assessor to try the case wholly or partially with his assistance."

His Lordship: Has this ever been done?

Mr. Terrell: On the request from the parties., No. But it has been done by the Court in one case. Counsel added that he doubted whether this case might not prove even more complicated than the one recorded case in which an assessor had been called.

His Lordship: It is quite clear that in this case you must have shorthand notes not only of the evidence but also of the arguments.

Mr. Terrell: I am not prepared on behalf of my clients to pay a share of the costs.

His Lordship: But a patent case like this cannot be tried without.

Mr. J. Hunter Gray, for the plaintiff, opposed the application, saying that for 31 years the Courts had been trying patent cases, and this was the first instance of such an application. Moreover, there was no information before the Court on which it could get a specially qualified assessor.

His Lordship: Who the assessor is to be is a different question, but at present I am only considering whether there is to be one.

Mr. Hunter Gray: My friend is asking you to appoint one now.

His Lordship: I shall order that this case be tried with an assessor. You may now go away and try to agree on one. If you make up your minds that you won't agree to anybody, then I must try to find some one myself, with such assistance as I can get.

Morgan Crucible Co., Ltd., *v.* Electrical Engineering and Equipment Co., Ltd.

This action, in which judgment in default of appearance by defendants had been given in the previous week, was mentioned again to Mr. Justice Eve in the Chancery Division on February 19th.

Mr. Hunter Gray, for the plaintiffs, said there had been some irregularity of service, and he could not sustain the order.

His Lordship: Very well. The order will not be drawn up.

Crompton & Co., Ltd.

[*The Rights of the Debenture-Holders.*]

In the Chancery Division on Monday, February 23rd, Mr. Justice Warrington heard a motion in the debenture-holders' action brought by Player and another against Crompton & Co., Ltd., and others. The motion asked for the appointment of a Receiver.

Mr. Clauson, K.C., and Mr. J. F. Carr represented the plaintiffs; Mr. Younger, K.C., Mr. Gore Browne, K.C., and Mr. H. E. Wright, were for the defendant company; and Mr. Douglas Hogg appeared for Mr. Ivor Bevan. Mr. Bevan is the trustee of a trust deed to secure the debentures.

His Lordship said the motion was one of an ordinary nature for the appointment of a Receiver. The question raised was whether the plaintiffs were entitled to maintain the action for the realisation of their security. It had been held in defence that the money was not payable because no event had happened such as would put the plaintiffs into a position to be entitled to realise their security. The plaintiffs held debentures issued by Crompton and Co., Ltd., in 1895. These debentures were further secured by a trust deed of January 26th, 1895, the trustee being Mr. Ivor Bevan. Last June Crompton & Co., Ltd., passed a resolution for the voluntary winding up of the company for the purpose of reconstruction. Subsequently t he business and assets of the mortgagor company were transferred to the last defendants, who were a company bearing the same name. Since the new company had taken over the old company's assets, the former company had executed a supplementary trust deed giving to the debenture-holders a specific charge on certain assets not included in the original trust deed. What was more material, they created a new floating charge upon the assets of the new company. A very large number—probably the bulk of the debenture-holders—had accepted that arrangement. Plaintiffs were the minority, and some said they were not bound by that arrangement, and the security they originally had was a floating security which had now crystallised. They held that they were now entitled to an order for realisation. The debenture stated that the principal moneys should become immediately payable if the company made default, or if an order was made or any resolution was passed for winding up the company otherwise than for the purpose of reorganisation, reconstruction or amalgamation, or if an order was made appointing a Receiver. In his Lordship's opinion, the plaintiffs were entitled immediately to sue and maintain an action and to obtain judgment when the proper time came. Plaintiffs, under the circumstances, asked for the appointment of a Receiver. Defendants quite truly said the new company was a prosperous company, and that the arrangement proposed was perfectly honest, and that he ought not, at the instance of plaintiffs and a minority, to appoint a Receiver. They said the appointment might damage the company. His Lordship said the right to the appointment of a Receiver was one of the ordinary rights accruing to a mortgage and especially to an equitable mortgagee who had no means of taking possession and whose security was realisable as one of the steps in the realisation. He thought therefore that plaintiffs were entitled to a Receiver. Inasmuch, however, as the company was a prosperous company, and to immediately put a stranger in possession of the assets might do some damage, his Lordship thought he might quite properly while making an immediate appointment, direct the Receiver not to give security or take possession of the assets until the expiration of a certain period.

Mr. Clauson said he was prepared to accede to a suggestion from the other side. This was to refer it to chambers to appoint a proper person, the order not to be proceeded with for six weeks except by the judge's order or by consent.

His Lordship made the order in those terms.

Metallic Seamless Tube Co. *v* A. W. Perot.

According to a report in the *Englishman*. this case was before the Calcutta High Court in January before Mr. Justice Chitty, when Mr. Brandt applied on behalf of the plaintiffs for an order for a consent decree. The plaintiff company carry on business in England, while the defendant is an electrical engineer and carries on business in Calcutta as A. W. Perot & Co. The present suit was filed in May, 1912, to recover Rs. 17,340, being the price of goods sold and delivered by the plaintiffs to the defendant. The parties were now agreed that the suit should be compromised and that a consent decree be passed, the defendant having undertaken to pay to the plaintiffs Rs. 6,363 in full satisfaction of their claim.

Mr. J. V. Watkins, having consented on behalf of the defendant, His Lordship granted a consent decree for Rs. 6,363.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

AUSTRALIA.—The Inter-State Commission, to which reference has been made in previous issues of the Electrical Review, have received applications for further tariff assistance in the case of the following, the existing rates for which under the preferential tariff for British goods are quoted:—

Petrol engines	20 % ad val. (no preference).

Applications for reduction of present duties or opposing suggested new duties have been made for the following goods:—

Generators for direct coupling to steam engines—	
Up to capacity of 200 H.P.	20 % ad val.
Over the capacity of 200 H.P. ...	12½ % „
Telephones, telephone switchboards and appliances (opposition to preference)	Free (no preference)
Electric metallic-filament lamps and electric incandescent lamps	10 % ad val.

Application for imposition of duties on iron and steel and other wire now free of duty and applications for the extension of the tariff preference to British goods in the case of the following goods have also been received:—

Engines, superheated steam, semi-stationary and crude oil engines ...	20 % ad val. (no preference)
Electric cable and wire (covered) ...	Free
Iron and steel wire	Free

These applications will be considered in due course.

SOUTH AFRICA.—H.M. Trade Commissioner has forwarded information as to certain further rulings which have been made regarding the new regulations for the declaration on invoices, of the home consumption value of goods imported into South Africa.

The Commissioner of Customs states that, with reference to the production of invoices showing home consumption values, in all cases where such invoices are not presented, deposits will be taken sufficient to cover duty on a 25 per cent. increase of the prices invoiced to the importer, pending the production of invoices showing the required particulars. It is further stated that, in cases of difference between the home and export selling prices, if the home

selling value is greater than when for export, the seller must give the price he can obtain when selling for home consumption, which is required of him. Unless, therefore, the manufacturer does give the higher value he obtains in his home market, the importer renders himself liable to a penalty for incorrect declaration, and the possible forfeiture of his goods. It is the intention of the Customs Department to check the accuracy of the declarations by actual inquiries in Europe. With regard to the value of goods on which duty is payable being either that at the place of purchase or free on board, the Customs Department have issued a Regulation to the effect that when a purchase is made by an importer (which includes his agent) *bona fide* inland, the railage to the port of shipment, if shown separately on an invoice or by a separate debit note, may be deducted for the purpose of arriving at the "true current value" as defined by law. The onus of proving the true place of purchase and the correctness of the deductions will rest with the importer. Ordinarily, the place where the invoice is made will be taken to be the place of purchase.

ICELAND.—A new tariff law recently passed provides for a duty of 2 öre per kg. on goods imported into Iceland other than those admitted free of duty or specially referred to in the tariff. This rate will apparently be applicable to electrical and similar goods. The law came into force on January 1st.

100 öre = 1s. 1½d.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

3,318. "Trolley heads for electric tramcars, locomotives, rope railways, and the like." L. JOHNSTON and G. W. GREEN. February 9th.

3,323. "Device for preventing the removal of electric lamps." C. WHARRAM. February 9th.

3,324. "Incandescent electric lamps." J. F. NEWTON. February 9th.

3,328. "Securing arrangement for electric cables." ST. HELENS CABLE AND RUBBER CO., LTD., and J. C. WHITE. February 9th. (Complete.)

3,336. "Protecting device for use with electric tramway carriages." T. TILING. February 9th.

3,342. "Incandescent electric lamps." G. HOOKHAM. February 9th.

3,358. "Machine telephone switching systems." WESTERN ELECTRIC CO., LTD. (F. T. Woodward, Belgium.) February 9th.

3,359. "Machine telephone switching systems." WESTERN ELECTRIC CO., LTD. (F. T. Woodward, Belgium.) February 9th.

3,360. "Impulse control systems." WESTERN ELECTRIC CO., LTD. (F. T. Woodward, Belgium.) February 9th.

3,371. "Systems of and apparatus for the wireless electrical operation at distance of a type-printing machine." FRANCESO DE BERNOCHI. February 9th. (Convention date, March 15th, 1913, Italy.) (Complete.)

3,385. "Switches for controlling electric motors." BRITISH THOMSON-HOUSTON CO., LTD., A. P. YOUNG, and E. GARTON. February 9th.

3,393. "Dynamos for generating electric currents." D. SUCHOSTAWER and J. O. OXLEY. February 9th.

3,431. "Devices for preventing disconnection of electric lamps from bayonet-type sockets." E. C. R. MARKS. (P. H. Powell, New Zealand.) February 10th.

3,455. "Centrifugally regulated dynamo-electric clutch." W. MORRISON. February 10th. (Complete.)

3,458. "Telephone and telegraph recording devices." C. WALTON. February 10th.

3,521. "Electrical damping-out or discriminating relays and the like." W. J. HEALY and P. S. WENTWORTH. February 11th.

3,530. "Universal electrical switch." L. BERETTA. February 11th. (Complete.)

3,538. "Electrically-operated reciprocating apparatus." T. F. WALL. February 11th.

3,552. "Electric train or tram control systems." J. R. BEARD and W. L. SHAND. February 11th. (Complete.)

3,583. "Contact-breaker device for electromagnetic vibrating members." A. H. MAITRE and V. H. G. MARTIN. February 11th. (Convention date, February 20th, 1913, France.) (Complete.)

3,587. "Electric measuring instruments." L. C. BENTON. February 11th.

3,589. "Alternating current machines and the like." R. B. RANSFORD. (Compagnie Universelle de Télégraphie et de Téléphonie sans Fil, France.) February 11th.

3,590. "Alternating-current machines, transformers, and similar apparatus." R. B. RANSFORD. February 11th. (Compagnie Universelle de Télégraphie et de Téléphonie sans Fil, France.)

3,591. "Method of regulating the length of electric waves in wireless telegraphy and telephony." R. B. RANSFORD. February 11th. Compagnie Universelle de Télégraphie et de Téléphonie sans Fil, France.)

3,592. "Wireless telegraph or telephone transmitters." R. B. RANSFORD. February 11th. (Compagnie Universelle de Télégraphie et le Téléphonie sans Fil, France.)

3,593. "Wireless telegraph and telephone transmitters." R. B. RANSFORD. February 11th. (Compagnie Universelle de Télégraphie et de Téléphonie sans Fil, France.)

3,594. "Electric current collectors." ALLGEMEINE ELEKTRICITATS GES. February 11th. (Convention date, February 12th, 1913, Germany.) (Complete.)

3,596. "Current-collecting devices for dynamo-electric machines." BRITISH THOMSON-HOUSTON CO., LTD., and F. P. WHITAKER. February 11th.

3,615. "Terminal or attachment fittings of electric conductors." H EDMONDS. February 12th.

3,643. "Construction of electric pocket-lamp dry batteries and outer shell or case containing the aforementioned dry batteries." J. S. HAMILTON. February 12th.

3,649. "Electric switches." IGRANIC ELECTRIC CO., LTD. February 12th. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)

3,650. "Electric circuit controlling devices." IGRANIC ELECTRIC CO., LTD. February 12th. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)

3,654. "Electrolytic apparatus." I. H. LEVIN. February 12th. (Convention date, May 9th, 1913, United States.) (Complete.)

3,658. "Working or controlling electrical machinery." SIEMENS BROS. DYNAMO WORKS, LTD. February 12th. (Siemens-Schuckertwerke G.m.b.H., Germany.) (Addition to 1,716/10.) (Complete.)

3,696. "Fuse device for electrical circuits." E. O. SCHWEITZER and N. J. CONRAD. February 12th. (Complete.)

3,699. "Electro-magnetic relays. WESTERN ELECTRIC CO., LTD. February 12th. (F. T. Woodward, Belgium.) (Complete.)

3,701. "Rotary electric switches." M. K. OWNBEY. February 12th. (Complete.)

3,702. "Incandescent lamp socket." H. MARKS and S. HELSEL. February 12th. (Complete.)

3,706. "Switches." W. W. DEAN. February 12th. (Convention date, February 18th, 1913, United States.) (Complete.)

3,722. "Electrical heating-apparatus." A. F. BERRY. February 12th.

3,742. "Relay mechanism for multiplex printer." D. MURRAY. February 13th.

3,750. "Electrical regulator." F. J. GRAY. February 13th.

3,756. "Ignition devices for internal combustion engines." W. PECK. February 13th. (Complete.)

3,763. "Apparatus for drawing wire." E. BUCKLER, legal representative of E. BUCKLER, deceased. February 13th.

3,818. "Thermal contact device for electric circuits." B. JEIDEL, *née* HENDEL. February 13th. (Convention date, December 5th, 1913, Germany.) (Complete.)

3,831. "Systems of electrical distribution. BRITISH THOMSON-HOUSTON CO., LTD. February 13th. (General Electric Co., United States.)

3,832. "Brush-holder and plug contact for use with magneto-electric ignition apparatus." UNTERBERG and HELMLE. February 13th. (Convention date, December 4th, 1913, Germany.) (Complete.)

3,835. "Electric furnaces." SOC. ELECTRO-METALLURGIQUE DE ST.-BERON. February 13th. (Convention date, February 20th, 1913, France.) (Complete.)

3,840. "Wireless telegraphy signal-receiving apparatus." W. A. BENTON and W. C. LOYNES. February 14th.

3,858. "Induction motors." W. HARTNELL and D. D. RAYNER. February 14th.

3,861. "Signalling-appliance of the electrical type for use in connection with colliery winding-engines." A. J. ROUTLEDGE. February 14th.

3,881. "Method of and means for effecting adjustment of length in running electric cables." H. S. HELE-SHAW. February 14th.

3,900. "Mounting bracket for switches and the like." A. HECKT. February 14th. (Convention date, February 14th, 1913, Germany.) (Complete.)

3,902. "Circuits for semi-automatic telephone exchanges." SIEMENS BROS. & CO., LTD., E. A. LAIDLAW, and W. H. GRINSTED. February 14th. (Complete.)

3,912. "Arrangements for regulating the phase displacement between the main current and voltage fields of a Ferraris meter. ALLGEMEINE ELEKTRICITATS-GES. February 14th. (Convention date, February 15th, 1913, Germany.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & CO., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

24,260. ELECTRICALLY-OPERATED MUSICAL INSTRUMENTS. R. Eisenmann. October 23rd.

29,531. GYROSTATICALLY-CONTROLLED MOVING BODY. J. G. Gray. December 23rd. (Cognate Application, 1,373/13.)

1913.

1,658. MEANS FOR FORMING CLAY BANKS EMPLOYED IN THE MANUFACTURE OF INSULATORS AND OTHER LIKE ARTICLES. W. Podmore. January 21st.

1,895. SWITCH FOR ELECTRIC LIGHTING ON A SMALL SCALE. Electromechanische Industrie Ges. & F. Herrmann. January 23rd.

1,915. MANUFACTURE OF TUNGSTEN. British Thomson-Houston Co. (General Electric Co.). January 23rd.

1,990. DYNAMO MACHINES FOR CONSTANT OUTPUT AT VARYING SPEEDS. W. G. Lee and P. J. Oldfield. January 24th.

2,372. ELECTRIC SAFETY LAMPS FOR MINES AND THE LIKE. T. Attwater. January 29th.

2,469. STORAGE BATTERY CHARGING. I. J. Simon, A. F. Roberts, & E. H. Chadwick. January 30th.

2,588. TIME MECHANISM FOR OPERATING ELECTRIC SWITCHES, GAS VALVES, AND THE LIKE. G. O. H. Horstmann, E. H. Horstmann, A. Horstmann, S. A. Horstmann, & W. T. Edgar. January 31st.

2,757. ELECTRICAL SWITCHES. William McGeoch & Co. and W. T. Reynolds. February 3rd.

2,918. TRANSMITTING APPARATUS FOR USE IN WIRELESS TELEGRAPHY AND TELEPHONY. G. Marconi. February 4th.

2,919. TRANSMITTING APPARATUS FOR USE IN WIRELESS TELEGRAPHY AND TELEPHONY. G. Marconi. February 4th.

3,445. PROCESS FOR THE MANUFACTURE OF IRON PARTICULARLY APPLICABLE FOR USE IN DYNAMO MACHINES, AND FOR LIKE PURPOSES. W. Rubel. February 10th.

3,462. ELECTRIC SWITCHES. British Thomson-Houston Co. (General Electric Co.). February 10th.

3,684. ELECTRIC MOTOR-CONTROL SYSTEMS. British Thomson-Houston Co. (General Electric Co.). February 12th.

4,425. SIGNALLING APPARATUS ON TRAMCARS AND THE LIKE. R. Heaton. February 21st.

4,472. ELECTRICITY PREPAYMENT METERS. British Insulated & Helsby Cables, Ltd., & L. B. Wilson. February 21st.

5,013. GENERATORS OF ELECTRIC CURRENT FOR IGNITION PURPOSES. G. A. Vandervell & A. H. Midgley. February 27th.

6,000. PREPARATION OF ACETALDEHYDE. Consortium für Elektro-Chemische Industries Ges. March 11th. (May 22nd, 1912.)

6,285. REGULATION OF DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. (Compagnie Francaise Thomson-Houston). March 13th.

7,137. MANUFACTURE AND PRODUCTION OF SOLUBLE CONDENSATION PRODUCTS OF FORMALDEHYDE. J. Y. Johnson (Badische Anilin & Soda Fabrik). March 25th.

7,722. INCANDESCENT ELECTRIC LAMPS. T. W. Lowden. April 2nd. (Addition to 1,180/12.)

8,267. TRACK CONTACT DEVICES FOR ELECTRIC TRAMWAY AND LIKE VEHICLES. A. Helfenstein. April 8th. (April 13th, 1912.)

8,464. ELECTRICALLY-DRIVEN CLOCKS. P. A. Bentley. April 10th.

11,960. ELECTRICAL CONNECTORS OF THE PLUG AND SOCKET TYPE. A. P. Lundberg, G. C. Lundberg, P. A. Lundberg & G. Pegg. May 23nd.

12,638. CONTROLLING OF ELECTRIC CLOCKS. F. Federico & L. Segalin. May 30th. (May 31st, 1912.)

14,035. SUPPLYING OF ENERGY TO RADIO-TELEGRAPHIC ANTENNAE. E. Girardeau. June 17th. (June 17th, 1912.)

14,799. STARTING DEVICES FOR EXPLOSION ENGINES. G. Lecocq & E. Van der Au. June 26th. (March 8th, 1913.)